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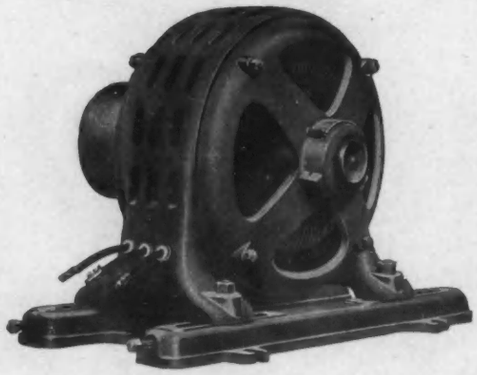

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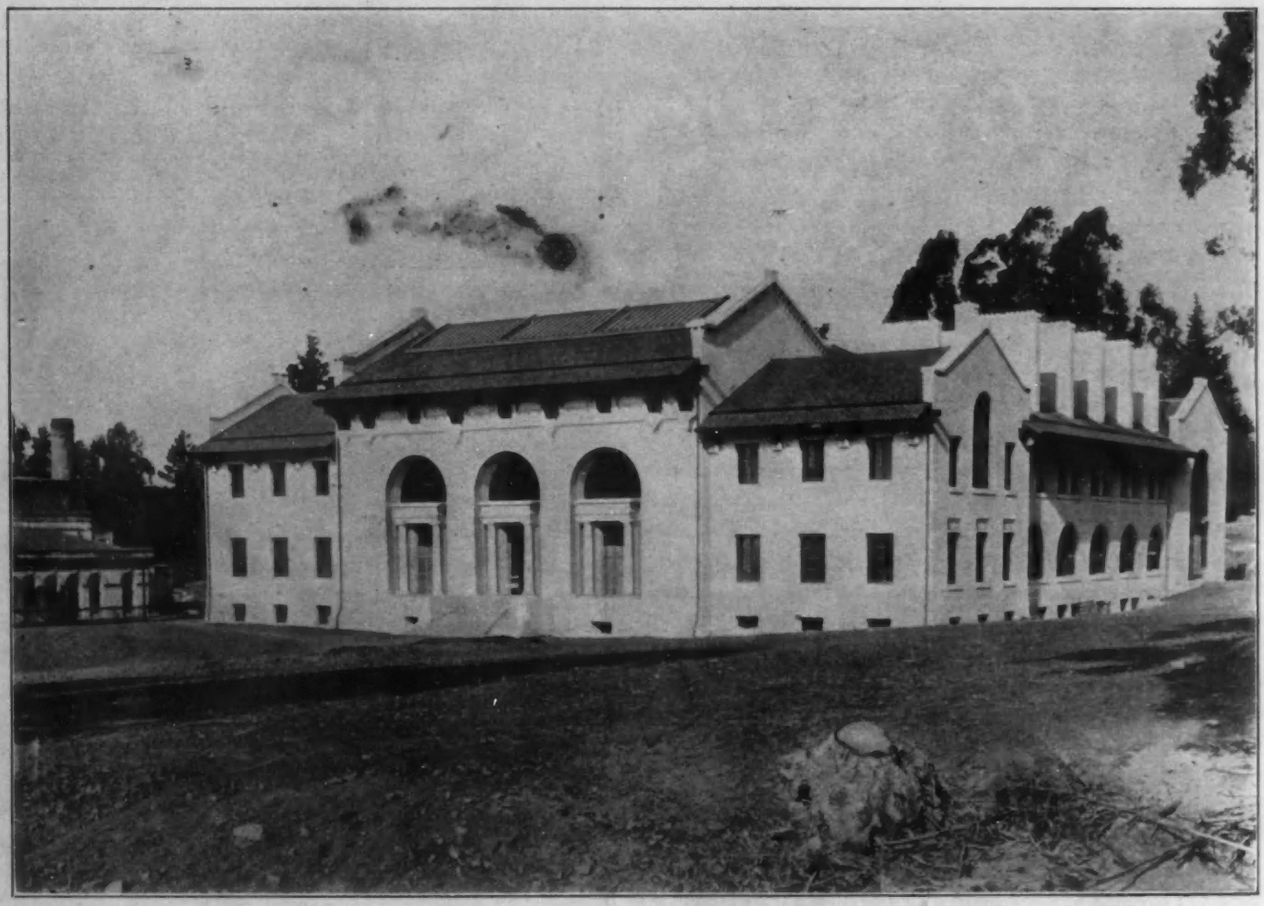
ENGINEERING POSSIBILITIES IN CALIFORNIA.*

By JOHN A. BRITTON.

The birthday of the science of engineering was contemporaneous with that of creation. When the Diety, resting from his labors at the end of the sixth period of time required for the formation of the Universe, looked upon his handiwork and pronounced it good, he had left imprints upon the vaulted firmament, upon the mountains and valleys, upon oceans, seas and lakes, as guides for mortal man to follow, and all that engineering science has accomplished since is in mere imitation of the samples furnished by the Creator. Architectural science was of necessity the first in point of importance, for created man must needs have shelter.



MINING BUILDING, UNIVERSITY OF CALIFORNIA

After the necessities of housing had been to the degree of demands fulfilled, engineering abilities took on the phase of providing for transportation, as primeval man was in a great degree nomadic in his tendencies, and, moreover, curious to know of other lands, and moved as well with the

*From address before Mechanical Engineering Association, University of California.

spirit of conquest; rivers had to be crossed, seas overcome, mountains passed; in nearly all cases of the opening up of pathways animal creation afforded the suggestions of travel, along the paths of least resistance, and afforded means as well as method.

As the world peopled and congested centers of population were formed and the more attractive portions of the earth became centers of government, and the earth unfolded its wealth to the adventurers, and building materials were designed, and means, now known of only in many cases by conjecture, were devised to produce the wonderful structures of the ancients; Egyptian architecture, as well as that of Greece and Rome; the temples of the Druids; the castles and fortifications of the Anglo-Saxon races; bridges not duplicated in our modern days of engineering; aqueducts, roads, colossal statues that called for the highest degree of skill in design, in knowledge of the effects of strain, wind resistances, stability of form, and in fact, all factors entering today into like characters of structure, stand as interesting monuments and examples of engineering ability, and yet with few exceptions the names of those who should be immortalized are either unknown or forgotten. Statues are raised, immortal poems are composed, and historical perpetuation made of poets, historians, soldiers, and statesmen, but for the engineer—oblivion. So you who are seeking today to be the masters of your craft, to labor for the advancement of your fellowmen, to make the pathways towards the success of your country by the development of its industries, must be content with your own achievements, as posterity will in all probability forget you as it has your predecessors.

In the world of mechanical, civil, electrical, mining and hydraulic engineering, the past thirty years have seen more accomplished for the betterment of mankind than, in so far as our knowledge extends, had been accomplished in the years since creation began. While heretofore the world had fattened on the luxuries of life, it is apparent that they were for the most part given to the favored few of fortune, and the masses of the people were dominated for the gratification of the few; then the world's numbers increased, and the older places congested, and newer countries, either by power of wealth or adventure became peopled, and the wanderers themselves by acquisition of wealth and power became the governors and not the governed, the problems of care of self awakened the latent powers of men, and to meet the conditions where luxuries became necessities, the inventive powers of men were called into play. War's hideous front was as much of a provocative of the necessities as the unfurrowed brow of Peace.

The development of the science of engineering that today annihilates space in the twinkling of an eye, that permits the girding of the earth with the thoughts of men in forty seconds, that turns night into day, that spans the seas with huge leviathans, whose prows scarce leave the cutting of the western waters until the eastern seas lap their gunwales, have all been made within the memory of men living today, and there are those within the sound of my voice, who, like me, have seen all these things, who have been part and parcel of them, and who by reason thereof look not with wonderment upon the accomplishments of men; but only wait for greater things, accepting each day's development with that calmness that has accepted all such as the right and prerogative of the people of the 19th and 20th centuries.

As we mark the flight of years, and count the brief space of time allotted to man, it is scarcely conceivable that all has been accomplished that tends today to make life bearable.

In electrical engineering it is a brief 76 years since Faraday discovered the principles of magnetic induction; but 40 years since Siemen brought out a self-excited generator driven by mechanical power; 27 years since Thomson Houston designed and successfully operated a constant current open coil machine; 17 years since the first polyphase generator came into use; 29 years since the first incandescent lamp; 20 years since the first incandescent system of lighting was installed; 20 years ago the first electric railway was operated; 24 years ago the first telephone system was installed; and in gas engineering in 1885 the Welsbach burner was invented by Auer von Welsbach; carburetted water gas invented by Lowe in 1873; crude oil water gas in 1889; and so the list might be interminably extended, but enough is here shown to prove the contention that the past 30 years have been the most productive of any in the world's history in development of engineering, for with all of the above have come marvelous changes in all mechanical, civil, and hydraulic work. The monster engine of 20 years ago of 1,000 horsepower is today a pigmy.

An engineering science little known or thought of, but one of the greatest factors in the progress of all others, that sprang full panoplied into existence, as did Minerva from the head of Jove, and has done more to advance all other co-ordinate branches, was the discovery in the year 1797, and its practical adaptation with few subsequent amendments in 1813, of the destructive distillation of bituminous coal and generation of coal gas, by Murdock, a Scotchman. Thus, the 19th century began with a science that has called into play all of the engineering attributes that belong to gas engineering. It is a matter to me of sincere regret that, so far as my present knowledge extends, but one college in the United States, that of Michigan, includes gas engineering in its curriculum. Later sciences are given a place, but this particular venerable one, which calls for a knowledge of engineering work, more diverse than any other, knocks unheeded at the door of learning, asking that the young man of today be taught in its way; but the day is rapidly approaching when the bars must be let down; the recent rapid development of gas engines for all mechanical and electrical purposes will make it essential that proper academic training be given to men who shall have the conduct of this phase of engineering pursuits.

Engineering possibilities in California have no greater field than in the study of the applied science of gas engineering. This science calls for all of the knowledge belonging to every other branch, and has much more that is

peculiar to itself. It first requires and demands of its followers a complete acquaintance with chemistry—analytical and organic; next, that they be mechanical engineers, capable of construction in any form. They must have an intimate knowledge of the uses and properties of all the materials entering into gas manufacture, and the diversified knowledge that goes to the understanding of the distribution of this commodity. It is a science of continual research, of never ending changes and phases. The world of today is as dependable upon a supply of artificial gas as it is upon daylight. From the moment that a pound of coal, or a gallon of oil is removed from Mother Earth until it emerges at the burner tip its manifold transformation affords a story as beautiful as it is practical. The Gas World today is in need of men of proper training to take up the burdens that have, alas, too long been borne by those who by accident or design, and with no other capacity than the hard knocks of experience, are masters of its affairs. The title of gas engineer will some day be one worthy to be borne and earnestly sought for.

CALIFORNIA HALL.

The State of California has been particularly fruitful of conditions which have assisted in the building up of a class of men whose reputations as engineers are known from one end to the other of the earth's confines, and the University of California has graduated men that today stand foremost. In no other State has the same combination of circumstances worked to the thorough and proper development of men in engineering training. Its lofty mountains on the eastern and northern borders, crowned with the ever lasting snows, present opportunities for the study of hydraulics as related to mining, irrigation and power, presented by no others; the central basin, formed by the Sacramento and San Joaquin Rivers, presents problems in irrigation and reclamation; the untold wealth concealed in the mountain fastnesses, or in the fertile valleys; problems and studies in mining of diversified characteristics; utilization of the power of the mountain streams in hydro-electric development; problems in questions of hydrostatics; application of power to interurban roads are aids in help of bringing out new industries for the commercial upbuilding of the prosperity of this Empire of States not possible anywhere without its confines. And be it remarked and considered in what a short space of time has all of this been accomplished. When the brave Argonauts harnessed the waters of the streams and grid-ironed the mountains with ditches and canals, to bring the forceful water to wash away the everlasting hills, and constructed in lonely canyons, dams for the conservation of the flood waters, they little thought the dreams of Franklin and Faraday would be realized by the practice of an Edison and Thompson, or a Tesla, and that the very works they erected to wrest the gold from the hills would be a power mightier even than gold to move the wheels of industry and to make man less dependable on the moon and stars. While in the earlier days of hydraulic mining little use other than that of the operation of giants or other forms of nozzles was made, in later

years the application of the Knight and Pelton buckets was made in the utilization of high heads of water for purely mechanical purposes, which ultimately led to their application to hydro-electric installations, although at first the turbine types of water wheels were employed, the first installation of McCormick turbine at Folsom, Sacramento County, being under 55 foot head. This was in 1895, a brief time since, as life of man is measured. Since then what wondrous strides have been made, and what wondrous engineering skill developed in the creation in this State alone of over 200,000 horsepower, delivered from hydro-electric plants. A full and comprehensive statement of the developments leading to the result, of the trials, tribulations, failures, and success would exhaust your patience and my powers, but a brief and hurried transcript may be allowed as a tribute to the men of California, who have made history in this particular, and to emphasize the caption of this lecture—"Engineering Possibilities in California." I say tribute to the men of California, for all the power plants of the State are the product of California brains, energy, skill, and engineering. The designers of these plants were graduates of California institutions, and the full development to their present standard of excellence has been made by men who have received their training on California ground.

In all of these later years of development, and even in the work being done today, the dominance of the engineer and the subordination of the business man has been apparent in many failures from a purely financial point of view, while the success of the enterprises has been largely due to the length of the purse that the business end was permitted to carry. Engineers, like all professional men, are, through no fault of their own, separated from business contact with the concerns for which they are acting, and as a consequence to the detriment of both. It would seem that when a student enters upon an engineering course in college, and subsequently takes up the actual practice of his profession, he has as a rule been barred by reason of his training from looking upon his work through the eyes of other than a mere theorist. Over the doors of all engineering colleges seems to be written the legend, "Abandon business, ye who enter here," for to the practical man it is notorious that a large percentage of the graduates of college, who leave it seeking an opening in their profession, are not equipped with the weapons that go to make a success in their calling. Too many of them are mere drudges, slaves to examples, to the rules of text books, to the T square and the compass, whose god is the slide rule. There must go with the engineer of the future a thorough comprehension not only of the mere details of the plans which he is called upon to originate, or to work out to a conclusion, but also a full and complete knowledge of the qualifying conditions that affect financially the inception, the construction and the completion of the plans. An engineer is today, or should be, the financial advisor of his principals; he must be competent not only to figure exactly upon the cost of his work, but also upon what his work will produce when completed; he must be in touch with men and with marts of trade; he must have daily intimate knowledge of the laws of demand and supply, he must make due investigations, exhaustive ones at that, of the fundamental principles underlying all engineering work, that of a determination of the true life of his structures, its true value as an investment, its depreciation, and its earning capacity on an actual commercial basis, and not on book or theoretical value; and an engineer in this 20th century without this ability, without this judgment, without this training, is the proverbial ship without a rudder; he is a drifter, whose ultimate end is the drafting room. All of the above, too, cannot be obtained by the engineer without the usual buffeting that comes of contact with the cold, cruel world. The graduate who expects within a few days after he says good-bye to his Alma Mater to parade his card bearing B. S., or M. E., or C. E., in the face of a practical man and obtain a position as engineer, misses his calling, and should take to oiling engines, or firing boilers. The world wants something more than theory. The world needs it, true enough, it cannot exist without it, and the foundation afforded by the academic training you receive is one that is like unto a house builded on a rock, but coupled with that must come the practical end to make effective the magnificent foundations.

Engineers without this special training have cost the promoters of enterprises in California more than three times the original cost of the work. It is hardly fair to ask the financier to shoulder all the errors, and this appeal is made to the student so that he may gird up his loins as he goes forth in the fight, and realize that in this day of big developments, of wondrous enterprises calling for his skill, his brain, his nerve, that the foundation of information obtained by years of scholastic training must be supplemented by a modicum of leaven of that practical side which turns many a failure into a success. No other profession in the world deals so closely with the world's commodities, none upon which the financier is so dependent, none where the latitude of action is so great. While it is largely true that in certain phases of engineering work there is room and need for the thinker to plan the bigger things, the world today is looking for the practical man who combines with his college training the attributes of one who can put such training into such daily uses, that he does not constantly need the directing or restraining hand of one who cannot always view things from a mere academic basis. For such men there is today, and there will always be in California, room at the top. There is more work being planned than there are men to perform. Be content for a while to stop, look, listen. Do not be too anxious to achieve fame and greatness; when fate throws the lasso it is with unerring aim, and he who stands in the foremost rank is no more certain of being encircled by it than he who is in the last of workers.

The possibilities of engineering in California are like its own resources, illimitable; the era of its prosperity is just unfolding. The call to the work is as yet feeble, but ere long the demands of the State in its upbuilding, the needs for the care of the millions who will people it call for the armies of men equipped with the knowledge that goes to the doing of things. It calls for Captains and Commanders, and your University today is striving to make of you Captains and Commanders of your chosen pursuits. Be faithful and true to your Alma Mater, that she may be proud of you always.

USE OF DEAD TIMBER IN THE NATIONAL FORESTS.

By E. R. Hodson.

A study of the amount, location, and quality of fire-killed timber, and of the extent to which it is used, has been made by the Forest Service in a number of the national forests in the Southern Rocky Mountain region. This brought out very strikingly, first, that sound dead timber is valuable, and, second, that though widely used in some localities, it is regarded as not worth using in others. The timber which was not being used was found to be fully as good as the other, and the only cause for rejecting it proved to be ignorance of its true value.

There are three classes of dead timber: (1) Fire-killed timber, (2) timber killed by insects, and (3) timber killed by such other causes as drying out or lightning.

Fire-killed timber, which is the best, forms by far the largest part of the dead timber in the national forests, and is found throughout them. Insect-killed timber, though widely scattered, is usually restricted to small areas. In some localities, however, particularly in the Black Hills, South Dakota, there are many millions of feet of such timber. Dead timber of the third class is mainly met with in single trees or small groups, but the aggregate amount of it is large.

Unless otherwise stated, the dead timber hereafter discussed is fire-killed timber.

The area covered by the study was approximately 13,000,000 acres. On this area there is estimated to be 500,000,000 feet B. M. of merchantable dead timber, or about four per cent of the total merchantable stumpage. About fifty per cent of this, especially of the larger dimensions, is fit for saw lumber, and all of it can be utilized in the round. There is also a large amount of cord-wood, suitable only for fuel, charcoal, and similar purposes.

The principal defect of fire-killed timber is check. This appears soon after the death of the tree and apparently does not greatly increase later. Timber above 9000 feet elevation is not affected by decay for many years. Such timber has been used after more than fifty years have elapsed since burning, and vast quantities of timber killed by fire twenty or thirty years ago are entirely free from decay.

Fire-killed timber should be barked soon after it is killed, in order to prevent decay of the surface. If the bark has been left on, the sapwood is somewhat decayed. Lodgepole pine and Engelmann spruce have about the same durability; after twenty-five years about fifty per cent is usually standing, and the fallen timber, if not flat on the ground, lasts five or six years. Balsam lasts about one-third as long. Standing Douglas fir lasts almost indefinitely, and even when flat on the ground decays but slowly. Yellow pine decays more rapidly, since it occurs mainly below an elevation of 9000 feet. On the other hand, on account of the openness of its stand, it is rarely killed by fire.

In many places it is the popular opinion that dead timber is very much weaker than seasoned green timber. It is even held that timber which has been dead a number of years is weaker than green timber, and that the longer it stands the weaker it becomes. These views are quite wrong. By actual test it has been shown that sound timber, as a matter of fact, is almost as strong as seasoned green timber and much stronger than green timber before seasoning.

The following table gives the strength of white fir (Abies concolor) killed by fire twelve years ago, and that of green timber of the same species and from the same locality:

Relative Strength of Green and Dead White Fir.

	Number of tests.	Moisture	Fiber stress at elastic limit.	Crushing strength.
		Per cent.	*Lbs. per sq. in.*	*Lbs. per sq. in.*
Green timber	97	47.9	2370	2595
Dead timber	58	13.6	4459	4824

Seasoning greatly adds to the strength of timber, so that in order to make the comparison a fair one the green and the dead timber must be brought to the same condition of seasoning. When this is done, the tests indicate that dead white fir is about nine-tenths as strong as green white fir which has been seasoned and about twice as strong as green timber freshly cut.

Since the principal defect of dead timber is check, it has been used largely in the round for mine timbers, coal props, telephone poles, railroad ties, and fence posts. The better grades are also used for dimension stock, which is not seriously affected by the shallow checks found in these grades. It is not much used for inch stuff, however, except as cut-up stock, because of frequent cross checks.

The chief use to which dead timber is now put is for mine timbers. For this purpose it is even better suited than green timber, because it is perfectly seasoned and is light.

It is estimated that the mines of Leadville, Colo., use each month 350,000 feet B. M. of dead timber. There are also many other large mining camps that use it in wholesale quantities. In these camps it is decidedly preferred to green timber.

For fifteen years dead timber has been used for railroad ties in the Pike's Peak National Forest, where it has proved entirely satisfactory. Wherever dead timber is located sufficiently near the track, it is readily sold for ties. Douglas fir, limber pine, yellow pine, range pine, and, occasionally, Engelmann spruce are the species used.

In Denver, Colo., dead timber has been used for a number of years for boxes, with excellent results. The species used were mainly Engelmann spruce and lodgepole pine. Limber pine and Douglas fir were also used in small quantities. The first two did very well, especially the spruce, which was used for such exacting packages as cracker and biscuit boxes. Dead timber is eminently suited for making boxes and crates, because it is odorless and is perfectly seasoned. A package made from it does not shrink or warp, but remains as tight as when first made. Since dead timber, when sawed, is largely cut-up stock, it should find a wide use for such purposes.

In smaller quantities dead timber has been used for telephone and telegraph poles, dimension stuff, and fence posts. In fact, it has been used for everything for which green timber is used, except thin sawed lumber, and there is no reason why it should not be used for this to a considerable extent also. Narrow widths of the best material, not damaged by checking, could be worked up into flooring and ceiling, and it could be used for second-grade lumber, which would not be seriously affected by a certain amount of checking.

The use of dead timber results in a double economy—the prevention of waste and a saving of more valuable timber for better uses.

It is past question that sound dead timber, particularly when fire-killed, has decided value and keeps this value for a considerable length of time. Decay does not readily affect it. The strength is not impaired by standing in the dead condition. Some of it is checked, to be sure, but even the best sound green timber is sometimes checked very seriously in seasoning.

THE HUMAN SIDE OF THE ENGINEERING PROFESSION.*

By V. Karapetoff.

Fundamental Thought:

Professional usefulness and personal satisfaction depend on the right conception of life and on the degree in which this conception of life is manifested in daily activity.

Part I.—Work and Conduct.

There are three essential requisites for an efficient and successful engineer:

A. Sound professional knowledge;

B. Knowledge of business forms and of human relations;

C. Good and strong character.

A. **Professional Knowledge.** A man who knows only "how" to do certain things, but does not know "why" they are done so, usually remains in subordinate positions. Get into the habit of analyzing; also, have your knowledge systematized.

In order not to get "rusty," you ought to do some study, or at least some reading outside of your daily routine work. This outside work may be classified, in an ascending scale of difficulty, as follows:

1. Keep notes on your regular work, with sketches, samples of calculations, etc. On separate notes keep matters of doubt to straighten them out at a future opportunity.

2. Read regularly at least one periodical relating to your specialty, and keep some kind of a general index on at least one subject in which you are particularly interested.

3. Be sure about the fundamental laws, facts, and assumptions on which your branch of engineering is based. If you are but recently from college, you can go over your old books and notes; otherwise read a good modern textbook.

4. Gradually get familiar with more advanced books treating of the various branches of your profession; go from time to time to the public library and see if there is anything new in your specialty.

5. Select some one branch of engineering, if possible somewhat different from that in which you are regularly engaged, and devote some time to it. Know more than the next fellow does; it will pay you.

6. Do not miss any chance to make an original investigation; this will develop your thinking, increase your self-confidence and raise your standing in the profession.

7. Inventing is the highest form of the engineering activity; there is no reason why you should not bring some improvement into the work in which you are engaged. Concentrate your mind on one thing, work patiently and persistently, and you will be sure to achieve something that will be new and useful.

B. **Knowledge of Business Forms and of Men.** You naturally expect some day to occupy a responsible position in your profession. This is impossible without a sound knowledge of established business forms and of human relations in general. Here again there are several stages of study and observation. Take up as many of them as your ambition, time, and ability will allow.

1. Observe the characters of men you are working with; in particular, the influence of their previous experience and education, of their age and temperament, of their views on general life questions, etc.

2. Observe things that make them efficient and happy, or that are impediments in their work; things that they would like to have and the main things that they object to.

3. Observe critically your superiors and their ways of acting towards their chiefs and subordinates. Do this without malice, but rather with a sincere desire to find out the best way of conducting the work, when you shall be called to perform their duties. Make for yourself a clear mental picture of an ideal man in a certain position, and try to follow this ideal in your own business life.

4. Observe and read about general business systems adopted in large modern commercial and industrial enterprises; in particular,

(a) Subdivision of the duties of various officers, and their correlation;

(b) Correspondence, accounting, orders, receipts, etc.;

(c) Causes of loss, waste, inefficiency, etc., and possible remedies.

Merely knowing the facts is not sufficient: you must see clearly the necessity for a certain organization. Only then will you find a right place in it for yourself and efficiently discharge your duties.

5. Do not get "rusty" on general life questions; read books on history, economics, philosophy, etc., with the view of finding the underlying facts and motives in human relations. Do not adhere too readily to a traditional school; work out your principles for yourself, and be willing to change them when new evidence is laid before you. A man in a responsible position must be a well educated man; he meets a great many men, and has to face new situations. Therefore he must be well informed on things in general, and ought to be able to judge about them.

C. **Training of the Character.** Engineering and business knowledge are the necessary conditions for usefulness ("success" and usefulness are not always the same), but the proper development of the character is the third necessary condition.

What is the use of having a profound knowledge of engineering, if you have not the necessary perseverance to achieve results; or to have a knowledge of business forms and relations, if your temper is such that nobody cares to be associated with you in business?

Practice daily the qualities of the character that you find essential for a good citizen and a good business man.

1. Work patiently on any problem until a result is achieved. If it should be impossible to get satisfactory results, at least make clear to yourself the nature of the hindrances.

2. Be honest in all things; do not be afraid to confess your mistakes or your ignorance. Train your character by doing your work over cheerfully.

*Abstract of an address, delivered before the New York Electrical Society, October 31st, 1906.

3. Keep down your selfish personality and ambition. Do not let them interfere with your business. The highest goal of personality and ambition is to have your part of the work done in the most ideal way.

4. Be generous, polite, and considerate to others; there are no circumstances where you would be justified in breaking this rule. Remain dignified even under unjust reproof.

5. Work with the understanding that your activity of to-day shapes your future. You need not trust to chance; your opportunity will come when you are ready for it.

Part II—Underlying Motives.

(A Theory of Life.)

Some men are happy and efficient in their work without having any clearly defined conceptions of life and its purpose. In a great majority of cases, however, a lack of a workable theory of life brings with it a decrease in possible efficiency and in personal satisfaction. It is of importance, therefore, to know

A. What are the principal limitations and wrong beliefs that are hampering engineers in their work.

B. How these limitations can be removed by working out a theory of life that gives a general meaning to man's activity.

C. How an engineer's work is shaped, when his underlying motives are illumined by such a theory of life.

A. **Usual Limitations** that prevent an engineer from being fully efficient and happy in his work:

1. Belief that he is underpaid; abnormal striving after money.

2. Belief that his efforts are not appreciated by his employer; also that there is no chance for promotion.

3. Lack of knowledge, theoretical or practical; lack of general education; a deficient knowledge of business forms and human relations. This is often accompanied by a belief that he has no time for study; in cases where a man has not exercised his mind for a long time, he has also to contend with his own mental apathy.

4. Deficiencies in character, such as weakness, roughness, egotism, narrowness, pedantry, absent-mindedness, laziness, etc.

5. Lack of enthusiasm due to the absence of a guiding and unifying purpose in life. This is particularly noticeable in very young men who are just beginning to form their own conceptions of life, and in older men who already see the end of their usefulness and cherish no more illusions.

B. **A Theory of Life.** Each man must work out for himself a practicable theory of life; this will make his acts and words, thoughts and feelings, harmonious and consistent. The experience of humanity past and present is the material to work on; his reason is called upon to interpret this, and his conscience is the court of final appeal.

The following is an example of such a theory of life: (**)

1. The Universe, including man, is governed by an Infinite Intelligence, which is manifested in man as his conscious life. There is no meaning in a man's life if it be detached from other men's lives. In proportion as he becomes conscious of this one, infinite life, common to all men, his own life becomes reasonable and harmonious, and the fear of poverty, sickness, old age, and death gradually disappears.

2. The highest purpose of life is to work for the realization of the above ideal conditions of life on earth. We do this either by actually removing certain hindrances and fetters (practical work), or by making this great work clearer to others (literary, educational work, preaching, etc.)

3. Once this attitude is understood, the real compensation for the work consists, not in money and notoriety, but in the state of consciousness reached. This is manifested in particular:

(a) In a clear and definite program of life, and a ready answer for all difficulties (doing your best).

(b) In a state of harmony and good fellowship with all men, through the understanding of that life which is common to all.

(c) In a freedom from fear, anger, jealousy, apathy, and other limitations caused by the assumption that life is an accidental chain of phenomena and circumstances.

C. **Work Illumined by Higher Ideals.** Once he has obtained a workable life-theory, all of the limitations enumerated above, that prevent an engineer from being efficient and satisfied in his work, can be removed by actually applying this theory to his daily work.

1. The belief that he is underpaid or not appreciated enough loses its power; the man works no more for a company or a corporation. He works for his conscience's sake, and finds his true compensation in the results of his work.

2. He is full of desire to do as much as he can, and not as little as he is allowed to. For this reason he wants to know much and to have his knowledge in a practical form, ready for use. He is active and studious all the time, and the expression "mental lethargy" is incomprehensible to him.

3. He frees himself from possible shortcomings in his character by keeping the ideal of perfection continually before his mind's eye. He no longer finds difficulty in handling men and in treating his co-workers and chiefs aright; he has a sincere sympathy for them, tries to help them, and to make their work more pleasant and efficient.

4. He is full of enthusiasm, for he is aware of the infinite importance of his life and work. His work is infinite as is Life itself; and each problem solved brings with it a higher and more important problem, brings more truth and light into his consciousness.

Conclusion—(Credo).

1. Make yourself ready for a broader and higher field of activity; then your opportunity will surely come.

2. The true purpose and value of engineering activity lie in providing better and easier ways for satisfying ordinary human needs. This provides more leisure and opens new possibilities for a higher spiritual and intellectual development of humanity.

3. The engineer's personal satisfaction consists in knowing this high purpose of his vocation, and in giving his service at a maximum efficiency. The other compensation is a result and not the purpose.

(**) It may seem presumptuous on the part of the writer, who is not a philosopher by trade, to formulate a "theory of life"; this he gives however, simply in order to illustrate what a practical doctrine of life (not a "canned" religion) may be. For the author personally this doctrine is the truth he believes in and according to which he tries to shape his life; for others it may serve merely as an example. He hopes that by criticizing his metaphysics readers may make their own conceptions on the subject clearer to themselves, and in this way be indirectly benefitted even by a theory presumably wrong.

STUDY OF ENGLISH LITERATURE.

In the course of an explanation of the study and teaching of English Literature in the "Yale Scientific Monthly," H. S. Canby asks the pertinent questions: "Why does English belong in the bill of fare of a scientific school? What right have we to ask a man who is trying to learn all about engineering in three years to step aside for Shakespeare? Or cannot even a member of the Select course, preparing for business, be more profitably employed in bookkeeping than on Pope?

The members of the various faculties in a university are assorted into sundry groups, each one of which is advertising a certain brand of life. If the professor is a scientist he is probably upholding an existence where facts are marshalled by the intellect towards success. If he is a teacher of literature, or of any subject not strictly professional or "practical," his ideal is probably a life where thoughts are ennobled to control noble and effective actions, and make for happy living. But only the grossest materialist would propose a life of pure facts, with such interesting elements as love, religion and the appreciation of beauty omitted. And only the most absurd of philosophers could try to teach a life of thought divorced from such facts as railroads, dry goods, money and food. Each, indeed, presents his ideal merely as a not-to-be-omitted part of the whole scheme of things, a view of life that must be taken as well as some others, with a bias, of course, towards his own pet arrangement of the emphasis.

The ideal of the teacher of English is culture, a word which may be defined in this connection by paraphrasing Matthew Arnold's definition, and calling it a knowledge of the best that has been thought in all ages of the world, with a view to the ennobling of our lives and to the extracting the highest kind of pleasure from them. Subtract culture from man and you push him many degrees back towards the ape. Add it, and, supposing him to have been a capable workman before, you enrich his work as well as his life because of the greater breadth of view he can bring to his task. This invaluable culture is hard to define more accurately. It is easier to point to a scientist like Huxley, who was also a man of culture, and so illustrate the word.

Perhaps it is safe to assert that in his heart of hearts the average reader considers poetry something good for the man of sentiment, and perhaps for all women, but to be partaken of personally only in moments of weakness. Now it is assuredly true that some men take to poetry more kindly than others, but to suppose that for the generality poetry is a superfluous luxury is to misunderstand the very nature of that form of expression which the strongest feelings and deepest thoughts given to man have almost always chosen. To say of a given man that it is impossible that he should ever enjoy any poetry is equivalent to an insult, since, except in the case of certain abnormal persons, it would be a denial of emotions and a love of the beautiful in thought or feeling. Poetry, of course, is by no means bound up with books. Caliban sucked his poetry from the "sounds and sweet airs" of his island, and many a man derives the poetical nourishment necessary for his soul from music, sunsets, railroads and bridges. But, in general, poetry, in the ordinary sense of the word, that is, written poetry, is the most efficient storehouse of this nourishment. It acts by the printed or spoken word, giving rhythm for the ear, meaning for the mind, beauty for all the senses at one and the same time. Since every thinking man, desirous of moving upward intellectually, is open to these influences, there should, for everyone, be somewhere in literature poetry which expresses and leads onwards his own thoughts and aspiration. If, in his progress through school and college, he has not found any, then either he has not chanced upon the proper poet, or, and far more, probably, he is bothered by the "accent," which the writer, born in some other century or intellectual sphere, has placed upon familiar language.

For, unfortunately, we cannot provide poets for the fireside and schoolroom to speak just the proper verses at the proper time. The best things are not all said in one generation, nor by men trained to speak in one fashion. Shakespeare had to write in Elizabethan, and so requires a glossary. Pope lived in the 18th Century, and necessarily wrote about life from a view point different from our own. Browning thought a mile or so above the most of us, and sometimes deals in phrases which require solving. These difficulties of language, of point of view, of intellectual calibre, all make up that which I have called the "accent" of poetry, and so result that very often the thought which we need to have expressed thoroughly and perfectly is to be found only in a strange dialect, and must be studied, interpreted, or at least thought about before we can understand.

Approved Electrical Devices

This department from time to time will contain an illustrated description of all fittings approved by the Underwriters' National Electric Association.

LAMPS, ARC.

Kliegel. Enclosed lens box arc lamp on a standard carrying knife switch and rheostat, each enclosed in an iron box, 30 A., 125 V. Approved October 13, 1907. Manufactured by the

Universal Electric Stage Lighting Co., New York.
Kliegel Bros., Proprietors.

RECEPTACLES, STANDARD.

Bryant: Wall sockets, 3 A., 250 V., Key and Keyless. Cat. Nos. 9184, 9185, 50,717, 50,753, 50,755. Straight-end angle wall sockets, including also the above types with attached shade holders. Also wall sockets mounted on K. W. link fuse rosette bases, 2 A., 125 V., Cat. Nos. 50,729-50,734, incl., 45,361, 45,362, 28,727, 28,732, and also above numbers with attached shade holders. Approved September 30, 1907. Manufactured by

Bryant Electric Co., Bridgeport, Conn.

Perkins: Wall Sockets, 2 A., 125 V., Key and Keyless, mounted on "Thomas" link fuse, rosette bases, cleat and concealed types, Cat. Nos. 24,990, 24,991, 24,993, 24,994. Also above types with shade holders attached. Approved October 1, 1907. Manufactured by

Perkins Electric Switch Mfg. Co., Bridgeport, Conn.

Weber: Wall Sockets, 3 A., 250 V., Cat. Nos. 672-677, inclusive. Cleat and concealed types. Approved October 1, 1907. Manufactured by

Weber Electric Company, Schenectady, N. Y.

SIGNS, ELECTRIC.

Talking Sign (formerly Nason Monogram). Approved October 9, 1907. Manufactured by the

Electric Motor and Equipment Co., Newark, N. J.

SWITCHES, AUTOMATIC.

Anderson Special Clock and Mechanism, in water-tight iron box, 2 or 3-pole, 15, 25, 50, 100, and 200 A., 250 V. Approved October 14, 1907. Manufactured by

Albert and J. M. Anderson Mfg. Co., Boston, Mass.

USE OF ELECTRICITY ON FARMS.

Clarence E. Edwords.

If all the latent energy which comes down from the snow-clad tops of the mountain chain which rims the eastern part of California were converted into electrical force, there would be sufficient power developed to drive every engine in the world. But there is one use where it is not necessary to have the far-away streams harnessed. Every farmer who lives on the borders of a little stream has at his door the means of supplying the energy that now comes from horses or back-breaking labor of men and women. While the expense would be minimized, the amount of work that would be accomplished and the amount of labor saved would make farming the ideal life in fact that it is in fancy.

Take the practical possibilities of electricity in use on a farm—or rather that are now in use on various farms—and apply them to one ideal farm, and see what it would mean to every member of the household. I have in mind a farm of one hundred acres, where the owner, his two sons of fourteen and sixteen and a hired man work all the year round, and additional help—sometimes two and sometimes three men—is employed during the rush season of fruit gathering. Five horses are kept at work, all requiring feed and care.

It costs $480 a year to hire the man, and it is estimated that the feed and shoeing of the horses costs $486 a year. Expenses of repair and replacement of harness, with value of time expended in care of the animals, may be estimated at the low figure of $34 a year, bringing the total up to $1,000 a year. Fuel and light may be estimated at $36 a year. In the house it takes the combined time of the farmer's wife and a servant to keep things going, while extra help is required during canning and preserving season.

If this farmer were to combine with three of his neighbors they could build the necessary dam, ditch, and power-house, install the power-plant and transmission wires, put in place necessary wires, motors, and apparatus on each farm at a cost to each individual of $1,500. This machinery would take the place of the hired man, horses, incidental expenses, light and fuel. Interest at seven per cent on the investment would be $105 a year, or about $900 less than it cost to run the farm under present conditions. It is necessary to compute the value of the horses and take that from the cost of the plant. Five good farm horses may be considered worth $500, thus reducing the cost of the plant to $1,000, making the interest expense only $70 a year. The expense of maintenance of the power-plant is inappreciable, as it almost runs itself when installed, requiring but a few minutes' attention two or three times a week, which work can be performed by a boy.

With a system of portable supply wires and converters, electricity can be applied to any point on the farm. The house may be heated and lighted electrically, saving labor in caring for stoves and lamps, preparing fuel and the cost of oil and wood. In the house kitchen work can be lightened, washing can be done, the sewing machine run, and numerous helps can be given to the women.

On the farm pumping, hay-stacking, wood-cutting, feed-chopping, churning, and hauling, besides numerous duties, can be performed by electrical appliances. The windmill can be taken down, and the farmer will not have to depend on nature for drawing water from the well or for irrigation. Electrical motors can run the wagons and all farm produce can be taken to town in automobiles run by electricity or by a neighborhood trolley, as is now in use in France and Germany.

The day will come when California farms will be run by electricity.—"For California."

ELECTRIC TRACTION IN SANTA CLARA COUNTY.

Joseph T. Brooks,
Secretary San Jose Chamber of Commerce.

Santa Clara County and the Santa Clara Valley constitute an ideal location for development of electric roads, not alone because of the equable all-year-round climate which attracts the tourist from every part of the world, but as well for the many points of interest and attractions which lie along the various routes already in operation in the territory named. We now have in operation and in the course of construction one hundred and sixty-four miles of electric roads in San Jose and Santa Clara County, and will eventually reach San Francisco, fifty miles away, with our electric service.

At present three lines of road are operating in the county. The San Jose, Los Gatos, and Interurban Railroad Company is now operating forty miles of trackage and building forty miles more. All of this is in the central and western part of the valley, and will eventually reach San Francisco. Included is a line direct to Stanford University, Palo Alto, and Mayfield, which will open up a new city, which will bear the same relative position to San Jose that Pasadena bears to Los Angeles.

The San Jose Railroad Company is operating sixteen miles of trackage in San Jose, which extends to the immediately surrounding towns, of which there are a number so closely connected with San Jose that it is but an imaginary line that separates them from this larger city.

The San Jose and Santa Clara Railroad has thirty miles of trackage, and is now ready to extend its building operations thirty-eight miles more. This company has in the course of construction twelve of the finest electric cars, costing $14,000 apiece, and which will be ready for service next spring.

All of this electric traction mileage, built and building, is within the County of Santa Clara. San Jose is the general center, and the terminus of each road. It is the beginning and ending of all the electric railroads of the famous Santa Clara Valley.

The power for this extensive electric service is rented by all of the roads at a cheaper figure than they can afford to make it. It is produced entirely in the mountains, where water furnishes a cheap means of making electric current on a large scale.

In addition to the roads now in operation, it will be but a short time when many of the local lines of the Southern Pacific will be converted into electric roads so that from San Jose one may tour the entire eastern side of San Francisco Bay into Oakland and Berkeley via an electric traction system.

Experience has taught that wherever the electric car presents an appearance values increase and the population increases rapidly. Build a road into a desert and there will people go, but when the road is extended into the most beautiful spots of a delightful country, there we find thousands will make their homes because of the easy access and inviting environs.

Within a few years a new road will be in operation from San Jose to Gilroy, which will open up to rapid transit one of the most fertile sections of the county. This road will run through Edenvale, Coyote, Morgan Hill, and Rucker to Gilroy.

Already surveys have been made to the Big Basin and also to Mt. Hamilton for an electric roadway.

Wells Fargo & Co. Express has seen the possibilities of an express service on all interurban roads in the county, and has established such service, so that the farmer or the person living at his country home may have his goods delivered at his door, or in return send products to the cities along the line.

THE POLICY OF JOLLY.

The average man wants to be pleased rather than benefited. He is after what he wants rather than what he needs. In other words, he likes to be jollied. And by "jollied" we do not mean tickled into surrendering his better judgment, but reached and pleased by sincere courtesy and won and retained by accommodation.

Mr. Average Man is going to use electric light if electric light pleases him. But he will use something else if that something else pleases him more.

Now, to please Mr. Average Man does not only mean for him to feel that electric light is a better light. Nor does it mean that he is getting a better value for his money. It simply means that he is made happier by doing business with the electric company.

In this sense courtesy and accommodation are the jolly. And dignity rather than frivolity is its essence.

Jolly of this kind must comprise: courtesy from every one; from the telephone operator to the central station manager, all the time from the first suggestion of a prospect to the end of business relations; fairness in rate and every condition; justice in treatment by every department all the time; consistent adherence to contract; liberality coupled with strict impartiality in construing of terms.

Honesty is everything. Make the people feel that they can not get along, not merely without electric light, but without your particular company. But don't tell them that. Let them discover it.

Such jolly will be a business-bringer, a friend-maker, the best foe to irresponsible agitation and municipal ownership.

Courtesy should be the carefully developed characteristic of the company and every one of its people. The prospect should be approached courteously. It is a mistake to think that courtesy is a weakness or a sign of inferiority, or that brusqueness is an indication of strength. Courtesy is simply a well-mannered sincerity and sincerity is always a strength.

The solicitor, or some official acting as a solicitor, is generally the first representative (won't some gifted word-coiner please give us a shorter term?) of the company to approach the prospect, and that prospect's future relations with the company depend to a large extent upon that solicitor as well as on that first approach. This approach should no more be with a "thou art greater than I" air than it should indicate an "I am greater than thou." Nor should it be a case of "I'm a good fellow, come do me a favor." It should be as one self-respecting man to another self-respecting man; and the whole conversation should be turned to the disposition and humor of the prospect. Only, never let a man say "No." Leave a ragged edge to pull back by if he is rebellious; to make a good landing place if he is receptive. Don't try to convince him of his ignorance, no matter how apparent it may be; don't impose your own knowledge, no matter how great. Leave out technical terms. Talk simply and plainly. Always use the shorter word and let him discover your knowledge. He'll do it more quickly—and convince himself more firmly—that way.

When the prospect comes into contact with the central station office this same courteous method should rule. The result will be that Mr. Prospect will discover that he likes to come over and chat and do business with you. That is the kind of spirit that lasts over night. And over several nights.

This same courtesy should mark the wireman who installs his lights, the meterman who reads his meter, the cashier who takes his money, the clerk who hears his complaints and the official who rectifies them. Train him so that whenever he comes to the office, or a company man goes to him, he smiles, not frowns. His friends will be influenced then, too.

Such a policy does not mean that the company's interests shall be sacrificed one iota. It means that they will be more easily safeguarded. Of course, there are some grouchies that all the Chesterfields in the world can't sweeten. They need the club. But remember that the club is as great a sourer of Chesterfields as sugar is a sweetener of the minor grouchies.

Then, after your prospect has become a user don't drop him. Go see him once in a while and talk about the ball game or the fishing. Don't mention business but listen to his little song of woe, when he has one, and straighten him out promptly and courteously. Don't tell him so, but let him gently discover that you think him a gentleman and a good fellow. Most men like to be liked. It is surprising how many good men carry a contradictory exterior, and it only takes a little sincere courtesy to turn up the better soil.

This is addressed to the solicitor so far, but it is to be remembered that every one who works for the company is a solicitor in a way and does his part to bring or repel business. The best solicitor on earth is useless if the conduct of the entire force from boy to boss, from the day the prospect is sighted hull down on the business sea until the long hereafter of his association with the company, is not of such courtesy as has been outlined.

Fairness in charges and in every other consideration of business is as essential as courtesy. No one likes to be overcharged. Honest men do not want to be undercharged. Every one wants to be treated fairly. That is natural. Convince your customers that your charges are fair. If they are less than those in some similar city, tell them why, so they can understand the advantage. If more, show them why, so they can see they are being treated fairly and are not being bled. If you want to make an enemy out of your best friend, let him think he is being bled. Whether it is true or not doesn't matter.

Justice and impartiality must go hand in hand with fairness. While the contracts are consistently adhered to and liberally construed, be absolutely impartial. A good many people want advantage over others. No one wants others to have advantage over him. Nothing makes a man so sore as to discover, or think, another is getting the best of it. And the fact that a man is getting favors over his competitor does not lessen his anger when he finds his competitor is getting a few that have passed over him. No station manager can balance a favoritism programme, so the only winning policy is impartiality.

It is also but simple justice, as well as good business, to care for the trade. The treatment should not only be courteous. It should be so thorough that a complaint could never be a kick, only a notification of something wrong. And that wrong should be righted at once. Meters should be set when requested, motors attended to when wanted, every attention given details so that no customer may lose one cent of money, one moment of time, nor have one bit of worry on account of the company.

The irresponsible agitation against corporations and the growing demand for that "king bee" fallacy of fallacies, municipal ownership, are founded on competent complaint—the inconsiderateness of such corporations. Exaggerated it certainly is, harmful it has been, more harmful it will be. Its remedy is education and consideration. The people would rather be done by a corporation—i. e., municipal—they think they manage than by one they know they do not. Let them see that your company is giving them part of the running. Let them feel that you are such a good fellow that they not only want your light, but want to do business with you. Then they will drop their fancy ideas and you will get the money.

There are no new truths in this paper. They are simply old truths brought out again, as they are so apt to get lost in the rush and shuffle of business and its attendant manifestations of human passion.—Electrical Review.

CURRENT COMMENT

The trackage of electric railways in the United States is nearly 40,000 miles, as compared with about 225,000 miles of single track of steam railways.

Niagara Falls are now illuminated at night by searchlights, equipped with color scintillators, giving wonderful chromatic lighting effects. The power is obtained from the falls.

Electric numerals which change every minute have been set on the Eiffel Tower in Paris. These are visible at night far beyond the city limits and give the official time to the surrounding city and country.

Plant growth is forced by electric arc lights and electrostatic discharges in experiments being carried on by H. B. Thwaites at the Royal Botanic Gardens, Regent Park, London, during the hours that the sun does not shine. The electric light rays are passed through a water screen and kept in constant motion to simulate natural conditions.

The world's largest gas holder is the newly completed 15,000,000 cubic foot gas holder at the Astoria works of the Consolidated Gas Company of New York. The diameter of the six sections varies from 300 to 285 feet, and the height when fully inflated is 253 feet. This can be filled in two and one-half days by the supply plant, which has a capacity of 6,000,000 cubic feet of coal gas per twenty-four hours.

Sleep produced electrically has been announced by Dr. Stephane Le Duc of the School of Medicine at Nantes, in France. It is claimed that it will replace the use of anaesthetics in surgery, as it is always under control and there is no disagreeable after effect. A 35-volt current is applied intermittently for minute fractions of a second by means of two electrodes placed against the skull, the points of application having first been shaved. An agreeable awakening occurs as soon as the electrodes are withdrawn. Electrocution is caused by certain modifications, and should be carefully guarded against.

The boiling points of metals have been determined by aid of the electric furnace by Dr. O. P. Watts as follows:

Zinc, 940 deg. C.; cadmium, 1025; lead, 1250; silver, 1850; copper, 2100; tin, 2170; manganese, 2200; nickel, 2450; chromium, 2500; iron, 2600; platinum, 2650; titanium, 2700; rhodium, 2750; ruthenium, 2780; gold, 2800; palladium, 2820; iridium, 2850; osmium, 2950; uranium, 3100; molybdenum, 3350; tungsten, 3700. Only the figures for zinc and copper are measured boiling points. The figure for tungsten must be some unknown temperature above the melting point (3200 degrees) and 3700 has been assumed arbitrarily. All other figures are not claimed to stand for the exact boiling points, but only to indicate the relative position of the metal in the series.

The wireless telephones on trial on the battleships Virginia and Louisiana, of the Atlantic fleet, have been given formal endorsement of the Navy Department by the purchase of twenty-seven sets at a cost of more than $35,000. Extension of the wireless system has also been authorized in an order issued for its installation on the supply ships Glacier and Culgoa, which will accompany the Pacific fleet, and on the Panther, now being fitted out at the New York Navy Yard as a repair ship. The wireless installation will also extend to the supply ship Celtic, now being overhauled at the Boston Navy Yard, although the Celtic is not expected to accompany the fleet. Wireless has also been ordered installed on the Arethusa, the supply ship now fitting out at Norfolk to accompany the flotilla of torpedo boat destroyers to the Pacific Coast. The apparatus will be supplied by the Radio Telephone Company, being built under patents granted to Dr. Lee DeForest.

A rifled oil-pipe line 256 miles long is being built for the Southern Pacific Company from oil properties in Kern County in the southern part of California to tide-water on San Francisco Bay. Spiral indentations accomplished in the rolling of the pipe constitute the rifling. An exhaustive series of experiments has demonstrated that after a small per cent of water has been added to the oil, and the necessary pressure applied, the whole will develop a whirling motion, and the water, being the heavier, will seek the outside of the pipe, enveloping the oil in a thin film or shell of water, greatly reducing the friction and allowing the core of oil to glide through the pipe readily. Throughout the length of 256 miles of pipe there will be twenty-three pumping stations, the equipment of each station being in duplicate, so that in the event of a breakage of any part of the machinery of one pump the other may immediately be put into service. With the size of the pipe, which is eight inches, and the high pressure and improved facilities, a rapid transmission of oil has been shown to be possible, and it is estimated that at least 23,000 barrels of fuel oil can be delivered every twenty-four hours.

An interesting sidelight on the rehabilitation of San Francisco and its prosperity is contained in the annual report of the Pacific Gas & Electric Company for the year ending June 30, 1907.

The San Francisco Gas & Electric, according to the reports, is earning practically as much annually as it did before the fire, showing that San Francisco has quickly returned to normal conditions. On the first of this year the company had 46,633 meters and 530 gas mains in use. For the year it sold 2,253,000,000 cubic feet of gas.

The California Gas & Electric operates in twenty-three counties, including this city and county, which contain sixty per cent of the population of the State and represent an area four times the size of the State of New Jersey. It has 637 miles of gas mains, 1500 miles of electric transmission lines, 55,000 gas meters and 31,000 fuel gas appliances in use.

During the year it sold 1,785,000,000 cubic feet of gas. Its gross earnings for the year were $7,186,133; operating expenses, $4,062,920; net income, $3,123,213; surplus, $1,481,076. The company earned twice its interest charges.

The two subsidiary companies gave to the parent company gross earnings for the year amounting to $12,164,399; operating expenses, $7,016,507; net income, $5,147,892; balance, $1,039,805. Seventy-five per cent of this balance was earned during the last six months of the year and it represents more than five per cent interest per annum on the twenty millions of common stock.

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EDITORIAL.

THE STREET LIGHTING PROBLEM.

Every city and town in the country has probably at some time given serious consideration to the best method of lighting its streets, public parks, and driveways. In the early eighties, when the direct current series arc lamp was first introduced and used for the lighting of streets, it seemed that for brilliancy and effectiveness, the concentrated white light of the carbon arc left little to be desired. The fact that the positive or hotter terminal quickly assumed the form of a white hot crater, was immediately taken advantage of, and the terminals were connected in the circuit so that the upper carbon was made the positive, and the lower carbon the negative terminal. The direct current arc, therefore, was especially adapted for illuminating directly underneath and adjacent to the lamp, the distribution of light being much more effective in the lower hemisphere than in the space above or in a horizontal line passing through the arc itself.

For many years the open arc series direct current lamp was so rapidly introduced as to practically eliminate its predecessor for street lighting purposes, the open flame gas lamp. The smaller number of arc lamps required to effectively replace the gas lamps caused a very great reduction in the number of individual sources of light. The extreme in that direction was represented by the plan adopted in many cities of building high steel towers, sometimes a half mile or more apart, there being suspended on the top of each tower from four to twenty arc lamps.

It was soon found, however, that although the tower system of lighting had many advantages for general illumination purposes, the dark shadows caused by high buildings were a serious disadvantage, and ground lighting of nearly uniform intensity, with a greater number of lamps generally distributed, was more to be desired than the brilliant illumination of space a hundred feet above the street level.

The concentration of light from an open arc in a single point, principally the upper or positive carbon, was also found to have many disadvantages, as it became more fully recognized that uniform illumination, rather than isolated brilliantly lighted spots, was the kind of lighting required for most satisfactory results, particularly for the general convenience of the traveling public, and as a preventative of crime, and assistance to the police department of the city.

These desirable features, coupled with the reduction in the cost of carbons and the trimming or putting in of new carbons in the arc lamps, materially assisted in placing the enclosed arc lamp in a most advantageous position soon after it was perfected and introduced for general use. Nevertheless, for the lighting of streets and general municipal lighting, the open arc was long continued in use, notwithstanding the fact that the enclosed arc had been for some time used for interior illumination.

It was not until the alternating current series arc lamp had been fully perfected along with the constant potential primary, to constant current secondary, transformer or regulator, that the open arc was effectively replaced by the enclosed arc for street lighting purposes. The new lamp made possible a very great saving in the cost of current, largely because efficient direct connected alternators could be used as generators instead of the relatively small, belt-driven, low efficiency, series, direct current arc machines with their complicated constant current regulators and high voltage commutators.

The light from the new arc lamp was less brilliant, however, and the change usually resulted in a considerable increase in the number of lamps installed in order to get equally effective illumination. Nevertheless, the ultimate result was a great improvement in the uniformity of the light over large areas.

During the years in which the arc lamp for street lighting had been undergoing a continuous development, the incandescent lamp had been found in many cities to possess advantages as a street illuminant, especially where trees interfered with the light of the arc lamps, which were usually suspended from the center of the street at the corners of each or every alternate block. Between street corners, incandescent lamps on the curb between the sidewalk and the street, either built as electroliers or put on brackets on the poles, were found to give excellent results and served effectively in supplementing the arc lamp, which gave light in four directions at the corners of the block. Complete incandescent street lighting systems were also installed, usually, how-

ever, in the smaller towns. The fact that approximately forty 50 to 55-volt lamps could be operated in series on 2,000 or 2,200-volt alternating current primary leads, these leads terminating at the power house, made the installation of the incandescent street lighting system not only economical in the use of copper, but exceedingly simple in construction and operation. Where very few incandescent lamps were needed simply to supplement a general arc lamp street lighting system, they could, of course, be operated in parallel on 110-volt circuits, the same as the commercial lighting systems.

Within the past few years the rejuvenated gas lamp system of street lighting has found much favor, and there can be no question that the color of the light from the Welsbach burner gas lamp is much more effective for street lighting purposes than the incandescent lamp. For business streets, electroliers containing either arc or incandescent lamps or Welsbach gas burners are without question the most effective, and at the same time the most sightly. Certain it is that with the use of the electric arc, incandescent lamp and the Welsbach gas burner, the brilliant illumination of city streets is easily and at the same time effectively accomplished. Which is the best system or which combination of the three types of street lights will give the best results, depends more upon the conditions found to exist in each city, than the relative individual superiority of either type of lamp.

BOOKS RECEIVED.

"The Motorman and His Duties," a handbook of the theory and practice of electric railway car operation, was written some time ago by Ludwig Gutmann, consulting electrical engineer. Five editions have been printed and sold. The sixth edition, which is just off the press, comprises a very complete revision and enlargement by Lawrence E. Gould, editor of the Electric Railway Review.

A question often asked by one who has not been favored with a technical education in electric railway subjects is, "Where can I find a book that will explain to me in a simple way the fundamental principles underlying the operation of an electric railway car and outline clearly the relation existing between the track, power station and the car itself?"

"The Motorman and His Duties" has been prepared especially to answer these requirements. It will be found to explain in language devoid of mathematics and technicalities, many points not generally understood by the average employee who has to do with the direct operation of a car or the care of electric railway rolling stock.

That a basis might be available on which to build a clear description of the intricate details of the motive power and brake equipment of an electric car, the fundamental principles of the electric motor are introduced in the second chapter. The third chapter considers the generating and distribution of power, outlining the essential parts of a power station and defining the method now most generally used for distributing current.

The working conductor and the use of transmission lines are outlined in Chapter Four. There follows in Chapter Five a discussion of the constructional details of electric railway motors of standard types. Car wiring and parts, including such features as the various types of current collectors, fuses, lightning arresters and sketches showing the various car wiring circuits, are introduced in Chapter Six.

The next three chapters, including fifty pages, are devoted to a detailed discussion of the principles, construction and methods of operation of controllers of various standard types. It is noted that the latest types of multiple-unit control and drum control using auxiliary contactors are considered.

Chapter Ten describes the various types of hand and power operated brakes and brake parts, comprising complete brake systems of the most modern types.

The concluding chapter of the book comprises a number of instructions to show how troubles on the road may be prevented or remedied. A glossary describing the principal terms and individual parts mentioned is a valuable part of this work.

"The Motorman and His Duties" in its eleven chapters comprises 198 pages, five by seven inches, attractively bound in green cloth. It is illustrated by 138 halftones and zinc etchings. It includes a subject index and three large inserts of car wiring diagrams. Net price, $1.50.

PERSONAL.

H. D. Boschken, of San Jose, visited San Francisco recently.

R. E. Rae, of the Western Electric Company, is visiting New York and Chicago.

E. W. Rockafellow, supply sales manager of the Western Electric Co. in the United States, is visiting San Francisco.

F. F. Skeel, representing Crouse, Hinds Electrical Co. of Utica, New York, is in San Francisco pushing "Condulets."

F. H. Murray, Los Angeles representative of the National Carbon Company of Cleveland, Ohio, was in San Francisco last week.

J. E. Bridges, of the Westinghouse testing laboratories, is visiting the Northwest, after returning to San Francisco from Los Angeles.

TRADE CATALOGUES.

Bulletin No. 421 from the Sprague Electric Company, 527 West Thirty-fourth Street, New York City, is devoted to the Greenfield Flexible Steel Conduit and accessories for wiring of modern buildings.

The Western Electric Company has published a little booklet on black enameled wire, which deals with the many direct and incidental advantages to be secured with this type of insulation, viz., an elastic yet resistant and firmly adhering film. The insulation is applied by special machinery, and the plant to produce it has lately been greatly increased. One of the leading merits, it is said, is that as compared with cotton or silk, it is very much less affected by heat, and will carry electrical energy under heat conditions that would cause cotton and silk to become charred and destroyed. The enamel will withstand a temperature as high as 500 degrees Fahrenheit for a considerable time without injury to its insulating qualities. It is not waterproof, but is proof against the moisture of the air, even in conditions of extremely high humidity over long periods. Data are given on these and other points.

Cutler Hammer Company, of Milwaukee, Wis., send an interesting booklet on lifting magnets, which they can now furnish in any size from a ten-inch up to a fifty-inch, or larger. A number of tests are outlined, showing remarkable efficiency owing to the coil construction and proportioning of the magnetic circuit.

LOCAL STOCKS AND BONDS

Furnished by Courtesy San Francisco Stock and Bond Exchange.

Outstanding	INTEREST	MISCELLANEOUS BONDS.	OCT. 31		NOV. 1		NOV. 2		NOV. 4		NOV. 6	
			Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1,532,000	F & A	Associated Oil Co. 5%	75	.....	75	.....	75	.....	75	.....	.....	80
2,250,000	M & S	Bay Counties Power Co. 5%	92½	.....	92½	.....	92½	.....	92½	.....	92	.....
1,000,000	F & A	Cal. Central Gas & El. 5%	.....	100	.....	100	.....	100	.....	100	.....	100
9,600,000	M & S	Cal. Gas & El. Gen. M. & C. T. 5%	68¾	.....	68¾	.....	68¾	.....	68¾	.....	68¾	.....
900,000	J & J	California St. Cable Co. 5%	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½
2,000,000	J & J	Contra Costa Water Co. 5%	.....	100	.....	100	.....	100¾	.....	100	.....	100
1,000,000	J & J	do do Gen. Mtg. 5%	.....	90	89½	.....	89½	.....	89½	90	89½	90
623,000	F M A N	Edison Light & Power 6%	109	.....	109	.....	109	.....	109	.....	109	.....
650,000	M & S	Ferries & Cliff Ho. Ry. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
671,000	A & O	Geary St. Ry. 5%	50	80	50	80	50	80	50	80	50	80
610,000	M & N	Honolulu R. T. & L. Co. 6%	.....	108	100	105	100	105	100	105	100	105
300,000	A & O	Lake Tahoe Ry. & T. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
800,000	J & J	Los Angeles Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100
1,300,000	J & J	Los Angeles Gas & Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100
5,000,000	A & O	Los Angeles Ry. 5%	.....	107½	.....	107½	.....	107½	.....	107½	.....	107¾
1,000,000	A & O	Los Angele Lighting Gd. 5%	.....	102	.....	102	.....	102	.....	102	.....	102
1,500,000	A & O	Los Angeles Pac. R. R., 1st Con. Mtg. 5%	.....	101	.....	101	.....	101	.....	101	.....	101
3,030,000	M & S	L. A. Pac. R. R. of Cal. 5%	.....	98	.....	98	.....	98	.....	98	.....	98
3,000,000	J & J	Market Street Cab'e 6%	.....	106	.....	106	.....	106	.....	106	.....	106
5,141,000	M & S	do Ry., 1st Cons. Mtg. 5%	.....	102	.....	102	.....	102	.....	102	.....	102
100,000	A & O	Mill Valley & Mt. Tamalpais S.Ry. 5%	100	.....	100	.....	100	.....	100	.....	100	.....
4,751,000	A & O	Northern Ry. Co. of (Cal.) 5%	.....	110	.....	110	.....	110	.....	110½	.....	110½
1,498,000	J & J	North Pacific Coast R. R. 5%	100	.....	100	.....	99¾	.....	99¾	.....	99¾	.....
1,074,000	J & D	Northern Cal. Railway 5%	105	.....	105	.....	100	.....	105	.....	105	.....
980,000	J & D	Northern Cal. Power Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100
6,000,000	A & O	Northern Electric Co. 5%	.....	99	.....	99	.....	99	.....	99	.....	99
1,000,000	M & S	Oakland Gas Light and H. 5%	101½	105	101½	105	101½	105	101½	105	101½	105
1,374,000	J & J	Oakland Transit Co. 6%	108¾	110	108¾	110	108¾	110	108¾	110	108¾	110
1,600,000	J & J	Oakland Transit 5%	101½	.....	101½	.....	101½	.....	101½	.....	101½	.....
1,326,000	J & J	Oakland Transit Con. 5%	.....	101	.....	101	.....	101	.....	101	.....	101
7,000,000	J & J	Oakland Traction Con. 5%	.....	98	.....	98	.....	98	.....	98	.....	98
1,500,000	J & J	Oakland Water Co. gtd. 5%	.....	95	.....	95	.....	95	.....	95	.....	95
2,000,000	A & O	Omnibus Cable Ry. 6%	.....	111	.....	111	.....	111	.....	111	.....	111
1,149,000	S D M J	Pacific Gas Imp. 4%	.....	95	.....	95	.....	95	.....	95	.....	95
8,494,000	J & J	Pacific Electric Ry. Co. 5%	.....	101½	.....	101½	.....	101½	100½	101½	100½	101½
4,491,000	J & J	Pacific Light & Power Co. 5%	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½
3,000,000	J & J	Pacific Tel. & Tel. Co. 5%	.....	102½	.....	102½	.....	102½	.....	102½	.....	102½
350,000	J & J	Park & Cliff House Ry. 6%	.....	104	.....	104	.....	104	.....	104	.....	104
250,000	J & J	Park & Ocean R. R. 6%	.....	104	.....	104	.....	104	.....	104	.....	104
700,000	M & S	Powell Street Railway 6%	.....	106½	.....	106½	.....	106½	.....	106½	.....	106½
2,500,000	M & N	Sacramento Elec. Gas & Ry. 5%	94½	95	90	.....	90	95	90	95	.....	94½
6,000,000	A & O	S. F. & S. J. Valley Ry. 5%	.....	110½	.....	110½	.....	110½	.....	110½	.....	110½
3,000,000	J & J	S. F., Oak. & San Jose Ry. 5%	100	102	.....	105	.....	105	.....	105	.....	105
1,500,000	J & J	do do 2d Mtg. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,500,000	A & O	S. J. & S. Clara Co. R. R. 4½%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
642,000	A & O	Sierra Ry. of Cal. 6%	102	.....	102	.....	102	.....	102	.....	102	.....
6,000,000	J & J	S. P. R. R. of Arizona 6% (1909)	.....	101¼	101	.....	101	.....	101	.....	101	.....
4,000,000	J & J	do do do (1910)	101¼	.....	101¼	.....	101¼	.....	101¼	.....	101¼	.....
5,116,000	A & O	S. P. R. R. of Cal. 6% (1912)	102	.....	102	.....	102	.....	102	.....	102	.....
4,127,500	M & N	S. P. R. R. of, Cal., 1st c. gtd. 5%	112½	.....	105	.....	105	.....	105	.....	105	.....
3,533,000	A & O	S. P. Branch Ry. of Cal., 6%	.....	122	.....	122	.....	122	.....	122¼	.....	122¼
81,178,000	J & J	S. P. R. R. Co., 1st Ref'd'g. 4%	84	.....	83½	85	83¼	.....	83¾	.....	83¾	.....
17,500,000	J & D	Spring Valley Water Co. Gen. Mtg. 4%	.....	87	.....	85	.....	85	.....	85	.....	85
300,000	M & S	Stockton Gas & Elec. Co. 6%	.....	105	.....	105	.....	105½	.....	105	.....	105
2,000,000	J & J	United Gas & Elec. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20,000,000	A & O	United R. R. of S. F. 4%	62½	64	62	.....	62	.....	61¾	64	61¾	.....
2,500,000	M & N	Valleys Counties Power Co. 5%	.....	95	.....	99½	.....	99½	.....	99½	.....	99½
		Water Stocks.										
		Contra Costa	.....	62	.....	62	.....	62	.....	62	.....	62
6,000	Quarterly	Marin County	45	.....	45	.....	45	.....	45	.....	45	.....
280,000	.....	Spring Valley Water Co.	.....	20	19	20	19	20	19½	20	19½	19¾
		Gas and Electric Stocks.										
37,500	.....	Martel Power Co.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9,340	.....	Mutual Electric Light Co. (Ctfs.)	4½	4½	4½	4½	4½	4½	4½	4½	4½	.....
37,336	.....	do (Extended Ctfs.)	.....	9¾	.....	9¾	.....	9¾	9	9¾	9	9¾
40,000	Monthly	Pacific Lighting Co.	65	.....	65	.....	65	.....	65	.....	65	.....
12,000	.....	Stockton Gas & Elec. Co.	52	.....	52	.....	52	.....	52	.....	52	.....
		Street Railroad Stocks.										
10,000	.....	California	.....	135	.....	135	.....	135	.....	135	.....	135
10,000	.....	Geary	.....	35	.....	35	.....	35	.....	35	.....	35
10,000	.....	Presidio	.....	25	.....	25	.....	25	.....	25	.....	25
	Semi-an.	Associated Oil Co.	24½	26	24½	26	.....	27	23	25	23½	26
1,625	Quarterly	Mill Valley & Mt. Tamalpais S. Ry.	110	.....	110	.....	110	.....	110	.....	110	.....
180,000	Quarterly	Pac. Tel. & Tel. Co. (Pfd.)	.....	80	.....	80	.....	80	.....	80	74¾	.....
180,000	.....	Pac. Tel. & Tel. Co. (Common)	10	11	10	.....	9½	10½	.....	11	.....	11

Unlisted Securities

250,000	A & O	Bay Counties Power Co. 6%	97	.....	97	.....	97	.....	97	.....	97	.....
745,000	M & S	Blue Lakes Water Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,000,000	A & O	California Northwestern Ry. 5%	.....	106	.....	106	.....	106	.....	106	.....	106
160,000	J A J O	Marin County Water 5%	.....	100	.....	100	.....	100	.....	100	.....	100
600,000	J & J	Risdon Iron Works 5%	.....	100	.....	100	.....	100	.....	100	.....	100
500,000	M & S	S. F. Dry Dock 5%	100	109	100	109	100	109	100	109	100	109
8,000,000	M & N	S. F. Gas & Electric 4½%	.....	95	.....	95	.....	95	.....	95	.....	95
3,926,000	J & J	S. F. & North Pacific Ry. 5%	.....	105	.....	105	.....	105	.....	105	.....	105
5,500,000	J & J	South Pacific Coast Ry. 4%	.....	90	.....	90	.....	90	.....	90	.....	90
.....	.....	Standard Electric Co. 5%	.....	85	.....	85	.....	85	.....	85	.....	85
.....	.....	do do Gtd. 5%	.....	85	.....	85	.....	85	.....	85	.....	85
750,000	J & J	Sunset Tel. & Tel. Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,250,000	A & O	Sunset Tel. & Tel. Co. 5%	.....	103½	.....	103½	.....	103½	.....	103½	.....	103½
1,000,000	M & N	Sutter Street Railway 5%	.....	103	.....	103	.....	103	.....	103	.....	103
		Stocks.										
50,000	Monthly	Gas Consumers' Association	.....	17½	.....	17½	.....	17½	.....	17½	.....	17½
100,000	Monthly	Northern Cal. Power Co.	.....	22	.....	22	.....	22	.....	22	.....	22
.....	.....	Pac. Gas & Elec. (Pfd.)	.....	.....	.....	.....	.....	.....	.....	.....	.....	45
.....	.....	Santa Cruz Port. Cement	.....	47½	.....	47½	.....	47½	.....	47½	.....	47½
.....	.....	Standard Port. Cement (New)	.....	50	.....	50	.....	50	.....	50	.....	50
80,000	Monthly	Truckee Electric Co.	13½	.....	13½	.....	13½	.....	13½	.....	13½	.....

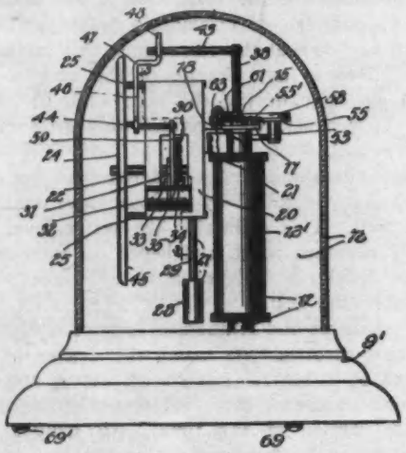
PATENTS

Electric, Gas and Water.

Specially reported for the Journal of Electricity, Power and Gas.

SELF-WINDING ELECTRIC CLOCK. 868,696. Arthur F. Poole, Wheeling, W. Va.

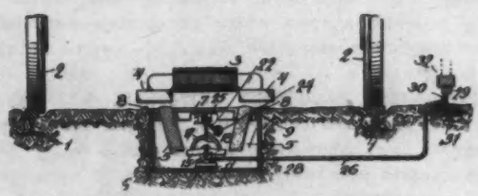
The combination with a clock train, of a weight for driving clock train, ratchet mechanism interposed mechanically between weight and clock train, an electromagnet, a movable armature therefor, mechanism for transmitting the motion of the armature to the weight and from the weight to the armature, a switch controlling the circuit of the



electromagnet, a switch actuating lever, a link pivoted on lever, a cam roller carried on link, a cam controlled by the armature and adapted to move forward and back under cam roller, there being a projection on the cam surface, stops independent of the rotation of the cam to limit the movement of the cam roller, and a spring acting to maintain cam roller on the surface of the cam and tending to move the cam roller away from the projection on the cam in that direction from the projection of the cam in which the cam roller may lie.

ELECTRIC SWITCH. 868,781. Chester S. Hill, Williamsport, Pa.

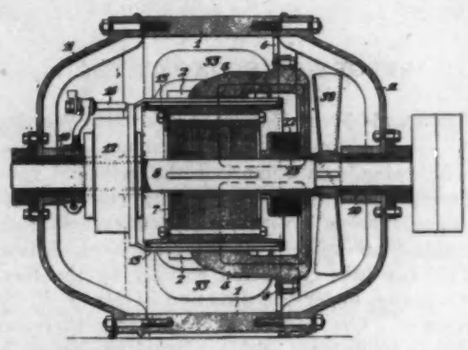
In surface contacts or sectional third rail systems, a control box, extension pole pieces within the same, a horizontal conductor shaft insulated from the control box, two or more armatures mounted upon the conductor shaft, means for insulating the armatures from each other, but not from the shaft, rigid curved contact members carried by



the armatures, flexible U-shaped contact strips in electrical contact with the source of current and having their free ends extending down into the path of the rigid curved contact members carried by the armatures and a sectional third rail in electric contact with the conductor shaft.

DYNAMO-ELECTRIC MACHINE. 869,102. Mathias Pfatischer, Philadelphia, Pa., assignor to Electro Dynamic Company, New York, N. Y.

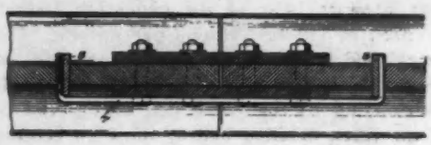
A commutation-pole construction for dynamo-electric machines comprising a magnetizable structure having polar projections, so mounted with respect to the armature that



the polar projections extend between alternate main poles of the machines and forming with the armature a plurality of closed magnetic circuits, and a magnetizing coil for structure so constructed and arranged as to magnetize all of the polar projections in the same sense.

ELECTRICAL CONNECTOR. 868,751. Frederick H. Ayer, Chicago Heights, Ill.

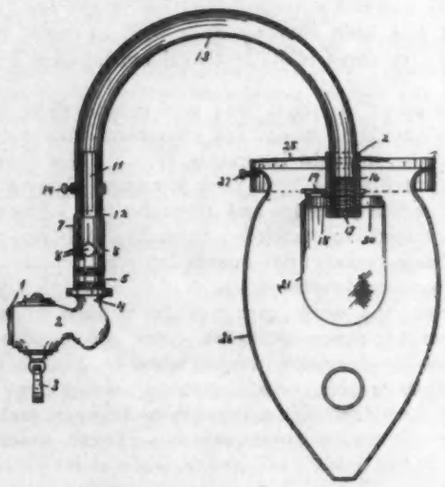
A bond wire or rod having the cross-sectional shape of



a three-sided figure, each side of which is formed on an arc described from the intersection of the other two sides.

INVERTED GAS-BURNER. 868,990. Thomas F. Kent, Newark, N. J.

In an inverted gas burner, the combination of a Bunsen tube, gas supply means at the lower end of said Bunsen tube, a tubular mixing chamber receiving at one end the upper end of the Bunsen tube and having a bore of



larger diameter than the opening of said upper end of the Bunsen tube, and a delivery end-piece at the other end of said tubular mixing chamber having an ignition opening whose cross-sectional area is the same as that of the opening of the upper end of the Bunsen tube.

INDUSTRIAL

REPORT ON ECONOMY TEST.

Seven Thousand Five Hundred Kilowatt Westinghouse-Parsons Steam Turbine.

The following data comprises the principal results obtained during the eight-hour economy test on September 1, 1907, upon turbine No. 253, installed earlier in the year at Waterside Station No. 2 of the New York Edison Company. This test was conducted entirely by the New York Edison Company, under the direction of Mr. J. P. Sparrow, chief engineer. The various arrangements therefore were carried out in accordance with a mutual agreement between builder and operator, entered into previous to the test, and the results, as herein given, were obtained by independent computation.

The turbine unit tested is of standard Westinghouse construction throughout. It has a maximum rated capacity of 11,250 kilowatts, and was built to operate on 175 pounds steam pressure, 28 inches vacuum and 100 degrees superheat. Under these conditions the turbine unit was guaranteed to have a minimum steam consumption of 15.9 pounds per kilowatt hour at the generator terminals, with a normal speed of 750 revolutions per minute. Incidentally the electrical efficiency of the generator was guaranteed to be 97.8 per cent, exclusive of friction and windage, at a load corresponding to that sustained during the test. The results of the tests, detailed below, show an economy about 7.5 per cent better than the guarantee.

Methods of Conducting the Test.

During the test period No. 2 Waterside Station sustained practically all of the 25-cycle load on the system, of which the unit under test carried practically 70 per cent, the remainder by the other turbine units in the station. This load was maintained as constant as possible by remote control of the turbine governor by the switchboard operator. Between the first and the last hours of the test, the maximum variation in load was held within four per cent above and below mean. Previous to the test, this turbine unit had been running on a load of 7,000 kilowatts, which was increased to its test load ten minutes before the start.

Three-phase electrical load was measured by the two-wattmeter method, using two Western indicating wattmeters of the standard laboratory type. These instruments were calibrated at the New York Electrical Testing Laboratories immediately before and after the test. Power factor was maintained substantially at unity, and all electrical readings were taken at one-minute intervals.

As a surface condenser was used in connection with this turbine unit, the water rate was determined by weighing the condensed steam delivered from the condenser hot well. This condensation was weighed in a tank mounted upon platform scales, with a reservoir above large enough to hold the condensation accumulating between each weighing. See the accompanying sketch. These weighings of 12,000 to 13,000 pounds each, were made at intervals of five minutes.

By the loop method of connecting the gland water supply, shown in the attached sketch, the necessity for correcting condensation by an amount equivalent to the weight of the gland water used, is avoided. It will be noted that continuous gland water circuit is used entirely outside of the weighing apparatus, and that all overflow from the stand-pipe returns to the hot well delivery.

As the circulating water is quite salt, any condenser leakage may immediately be detected by the salinity of the condensed steam, which should be pure distilled water. On this account, condenser leakage was determined entirely by chemical analysis, employing the silver-nitrate test with a suitable color indicator. This method proved extremely sensitive, and possessed a decided advantage over the ordinary method of weighing the leakage accumulating during a definite period when the condenser is idle and under full vacuum. As samples of circulating water and condensed steam could be taken at the same time, this method made it possible to discover any change in the rate of condenser leakage taking place during the test, while the method of weighing, above described, provides only an average result during the period.

In this condensing plant, the delivery of hot well pump it automatically controlled by a float valve in the interior of the hot well. This maintains the water level therein at a practically constant point, and hence no correction had to be made for difference in level of water in the hot well before and after the test.

Steam pressures and temperatures were determined close to the turbine throttle. As usual, the degree of superheat was obtained by subtracting from the actual steam temperature the temperature of saturated steam at the corresponding pressure carried at the time. All gauges and thermometers were calibrated previous to the test at the U. S. Testing Bureau. It will be noted that both pressure and superheat were somewhat below the guarantee.

Vacuum was measured directly at the turbine exhaust by means of a mercury column with a barometer alongside for reducing to standard barometer—30 inches. This also obviated the necessity of temperature correction between the two mercury columns. During the test, the vacuum was not maintained quite up to normal.

Results of Tests.

The following data represents the results of the tests, calculated for the conditions as actually run; i. e., for internal errors only:

Duration of test.....9:30 a. m. to 5:30 p. m.	
Avg. steam pressure at throttle, lbs. per sq. in. gauge	177.5
Avg. superheat at throttle, degrees F.....	95.74
Avg. vacuum (referred to 30" barom.) in Hg.....	27.31
Avg. load on generator, Kw.....9,830.48	
Avg. steam consumption, as tested, lbs. per Kw. Hr..	15.15

Owing to the departure, during the test, from specific operating conditions upon which guarantees were based, it was necessary to correct the observed results by the following amounts:

Pressure (2.5 lbs. high) correction, 0.25 per cent; vacuum (0.69 inch low) correction, 1.84 per cent; superheat (4.26 degrees low) correction, .29 per cent.

These corrections were mutually agreed upon previous to the test as representative of this type of turbine. When applied to the observed steam consumption given above, the following results, representing contract conditions, are obtained :

Avg. corrected water rate during

8-hour test .....14.85 lbs. per kilowatt hour
Guaranteed water rate.....15.9 lbs. per kilowatt hour

Referring now to the accompanying log, it is interesting, as a check upon the average figures above presented, to observe the results segregated into hourly periods, as shown. Here it will be noted that the load was considerably lower during the first and last hour than during the main part of the test. Neglecting, therefore, these two hours and considering only the six-hour period from 10:30 a. m. to 4:30 p. m., the results are as follows:

Average corrected water rate, six hours..14.8 lbs. per kw. hr.
Equivalent water rate.....10.65 lbs. per bhp hr.
Equivalent water rate..... 9.8 lbs. per ihp hr.

The two latter quantities are determined by applying conversion factor for generator efficiency and for internal losses.

In connection with these tests, a noteworthy agreement exists between the results noted and those previously obtained from tests of machines similar in design installed in the Manhattan station of the Interboro Rapid Transit Co., New York, and the Long Island City station of the Pennsylvania Railroad. At the same loads, and with equivalent operating conditions, the performance of the machines is almost identical. These economic results, while not exceeding in actual steam consumption the best records of European practice, yet are extremely good in view of the moderate operating conditions under which the test was conducted. In fact, they represent the best results that have yet been obtained by any turbine under the conditions named.

ARIZONA POWER COMPANY.

This company, formed under the laws of Arizona in 1902, is proposing to develop the water power of Fossil Creek, Yavapai County, Ariz., in order to supply electric power to the cities of Prescott and Jerome and the large mining district adjacent to these cities. The cost of fuel in this district is excessively high, and the United Verde Copper Co., of which Senator Clark is president, has entered into a ten-year contract to purchase 1500 horsepower of the first development of 3,560 horsepower at about $100,000 yearly, which amount, it is pointed out, practically guarantees 75 per cent of the interest on the bonds now to be issued, as below shown:

Capitalization—	*Total Authorized*	*To be Issued now*	*Reserv'd for Ext'ns,&c*
25-year 6 per cent gold bonds (dated Nov. 1, 1907, and subject to call at option of company on and after Aug. 1, 1913, at 102 per cent and interest).....	$2,000,000	$1,500,000	$500,000
6 per cent preferred stock, cumulative from Nov. 1, 1911.....	1,000,000	750,000	250,000
Common stock (par of shares $100)	3,000,000	3,000,000	.....

To complete the first development, estimated to cost $1,201,924, William P. Bonbright & Co., of New York, F. S. Viele, of New York, and A. C. Balch, of Los Angeles, Cal., as bankers, are now offering for sale $1,500,000 bonds, $750,000 6 per cent preferred stock, and $750,000 common stock, in blocks, each consisting of one bond of $1,000 with five shares of preferred stock ($500) and five shares of common stock ($500), for $900.

Estimated Earnings from First Development, 3,560 Electrical Horsepower.

Estimated revenue		$366,000
Operating expenses, maintenance, depreciation, etc.	$72,000	
Bond interest, $1,500,000 at 6 per cent.....	90,000	
Preferred stock dividend, $750,000 at 6 per cent.	45,000	207,000
Annual surplus during first five years after completion of plant		$159,000

After five years a sinking fund of 2 per cent will call for $30,000 annually.

The Electric Operating Construction Co., of 49 Wall Street, New York, and Union Trust Building, San Francisco, under date of 49 Wall Street, August 1, 1907, writes in substance:

"The waters of Fossil Creek provide the only feasible source of hydro-electric power within 200 miles of the mining district surrounding Prescott. The waters are of permanent character, since, coming from subterranean sources, they are in no way dependent upon rainfall, the uniformity of their flow for over thirty years being testified to by men familiar with this portion of Arizona, and careful measurements for seven years fully corroborating this testimony. There is available forty-three cubic feet of water per second, and this will be developed in two sections, separated by only 5½ miles, the upper development having an effective head of 480 feet and the lower development of 1085 feet.

"It is proposed to develop the lower plant first. This will require approximately six miles of flume, ditch, tunnel and pressure pipe, and will deliver to customers 3560 continuous 24-hour horsepower. The upper plant will be built as soon as possible after the lower plant is completed, with 5 miles of ditch, flume, tunnel and pressure pipe; it will deliver 1569 continuous 24-hour horsepower. All construction will be of the most substantial character. The single steel tower line with duplicate circuits for both developments will not exceed 100 miles, with 50 miles of single distributing lines.

"The requirements of the district are largely in excess of the power generated by both plants. The price of crude oil is from $1.50 to $2 per barrel, and the price of coal from $4.25 to $5.50 per ton at the various railroad points in this district, the cost at the mines being increased from 25 per cent to 100 per cent, according to the haul.

"The United Verde Copper Company at Jerome, Ariz., has entered into a contract with the company for 1500 electrical, 24-hour, continuous horsepower for ten years at approximately $100,000 per year, payable under all conditions, except in case of strikes, when two-thirds of this power must be paid for whether used or not, with no penalty upon the power company for failure to supply power, save loss of revenue. The town of Prescott (Yavapai County) with 7000 to 8000 inhabitants is now supplied by the Prescott Electric Company, with gross receipts of about $80,000 per year. Annual revenue of $50,000 can readily be secured from Prescott, either by working with the present company or by a separate distributing system to reach the larger consumers, selling power at 5 cents per kilowatt hour. An actual canvass of the larger mines shows fifty-four mines having engines rated at 4900 horsepower, the average cost of which, it is said, is over $250 per year on a 24-hour basis. As already stated, a contract has been made on a flat-rate basis for 1500 horsepower. If the balance of the power is sold on a meter basis at 2 cents per kilowatt hour, it will yield $130 per horsepower, effecting a material saving to consumers. However, it is expected that power can be sold more advantageously in most cases."

NEWS NOTES

FINANCIAL.

Los Angeles, Cal.—A resolution has been adopted by the City Council formally offering to sell to the State Board of Examiners bonds in sum of $510,000 of the first issue of the Owens River water bonds.

San Jose, Cal.—A resolution of intention declaring a municipal lighting plant a public necessity and preparing the way for a bond election, has been adopted by a unanimous vote of the City Board.

Red Bluff, Cal.—At a meeting of the Directors of the Pacific Power Company, Dr. A. P. Tarter, of Tehama, was elected president, and H. S. Gans, of the law firm of McCoy & Gans, director. The matter of financing the proposition has been turned over to A. A. Martin, of San Francisco, who is manager and vice-president. The Pacific Power Company has absorbed all the interests of the Mill Creek Power Company, J. A. Whitehead having resigned as president and director.

San Diego, Cal.—It has been decided by the Board of Directors of the San Diego Electric Railway Company to call a meeting of the stockholders of that corporation to consider the advisability of increasing the capital from $500,000 to $5,000,000. The date of this meeting has been set for January 21st. It has been found that the present capital stock of the corporation is inadequate for the vast amount of improvement and extension work which has been done in the past few months, and which is to be continued in the near future.

San Luis Obispo, Cal.—The Directors of the Brookshire Oil Company have met and declared a dividend of four per cent to the stockholders. The prices reported as having been paid in the Santa Maria district indicate a breaking of all records, and it is estimated that property in the upper part of that district has increased in value fully four-fold since the first of the year. The Weil 60-acre tract in this field was sold to the Lucerne Oil Company for $2,000 an acre, and in other parts even undeveloped land located some distance from proved wells, has changed hands at prices ranging from $1,000 to nearly $2,000. The record sale thus far reported, however, was the option to purchase by the Santa Maria Central Oil Company of the Speed 30-acre tract, at $3,000 an acre.

ILLUMINATION.

Calistoga, Cal.—An electric light, heat and power franchise has been awarded to Henry Brown.

Los Angeles, Cal.—The Seaboard Construction Company is making a canvass preliminary to establishing a competitive company.

Hollywood, Cal.—Contracts are now being signed by those who desire gas from the proposed plant to be established by the Southern California Gas Circuit Company.

Newport, Cal.—The Chamber of Commerce has taken up the matter of a gas plant, which C. L. Chamberlain has submitted for consideration. Mr. Chamberlain proposes to organize a company for the manufacture and sale of gas. Another meeting will be held to give it further consideration.

Los Angeles, Cal.—L. C. Brand has asked the city of Glendale to pay $21,000 for his entire electric light and power system. The plant is said to be on a paying basis, but in order to give service wherever required it would be necessary to make considerable additions to the lines. It would probably require a bond issue of $40,000 to purchase the plant and make the needed extensions.

Riverside, Cal.—J. E. Tibbetts and associates have asked for a franchise from the city of Newport to cover a gas, electric and water plant, which the syndicate desires to establish there. The city would not consider a gas plant. The company proposes to have one central power plant, and pump water by electricity. The surrounding places will be taken in.

Santa Rosa, Cal.—Sealed bids will be received to November 4th for furnishing one Gamwell four-circuit automatic storage battery switch board, complete with motor generator, to be installed by the party getting the contract. Bids are to be accompanied by a certified check of 10 per cent of the amount of the bid, payable to the Mayor of this city. The right is reserved to reject any and all bids.

San Diego, Cal.—The Consolidated Gas and Electric Company has cut rates on its electric current and proposes to double the capacity of the plant, the work to be carried out at once. Some of the additional equipment and machinery is already en route. The capacity of the gas plant is also to be increased, and orders for additional equipment are to be placed in a short time. During the present month a 520-horsepower boiler will be added, which is expected to arrive any day.

Stockton, Cal.—At the last meeting of the Weber Avenue Improvement Club the contracts for installing the contemplated lighting system were awarded to the lowest bidders. The contract for laying the conduits was let to S. B. McLemegan on his bid of 80 cents per foot. Jackson & Earle were awarded the contract for electrical work for $2,167.50. The contract for the poles was awarded to the Stockton Iron Works for $1,299.

WATERWORKS.

San Francisco, Cal.—After an extensive trip through the valleys of the Hetch-Hetchy and the Tuolumne, made to inspect the water supply, Supervisor Thomas Magee has returned to San Francisco, and will file the report of his investigations with the Supervisors' Water Committee. Mr. Magee spent the greater part of his time examining the physical condition of the country surrounding the valleys. Most of his trip was made in an automobile. Horses and pack mules were used from Sonora over the Sierras into Hetch-Hetchy. During the trip he visited the irrigation districts of Turlock and Modesto. He also investigated the prior claims entered by the owners and promoters of several large projects in the San Joaquin Valley, to the exclusive right of utilizing the water supplies in Hetch-Hetchy and Tuolumne Valleys.

ELECTRIC RAILWAYS.

Anacortes, Wash.—The survey gang, under Chief Engineer Clark, has commenced work on the survey lines for the proposed interurban electric railroad between this city and Sedro-Woolley.

New Westminster, B. C.—Tenders for construction work on the first portion of the line between this city and Cloverdale, will be called for next week. Cars are to be running into Cloverdale by Christmas, 1908.

North Yakima, Wash.—The Yakima Valley Transportation Company, the local electric concern, has purchased for $4,000, property on the corner of Front and B Streets, near the Northern Pacific depot, for its waiting rooms and ticket and expess office.

Eugene, Ore.—Engineer Kloydahl and his crew began the survey out of Eugene along the river road route for extension of the Eugene & Eastern electric road from this city to Salem, the lines having been run south from Salem to Albany. Projectors of this line mean business and are ready to go to work. Eugene should get busy at once on this. A. Welch, representing the company, is in the city and went over to Springfield to arrange for putting in a new boiler due to arrive November 1st, by which extra power will be generated for operation of the electric car system. The passing switch left Portland Saturday, and will be put in upon its arrival. The crossing at East Thirteenth has been ordered and will reach here the first of next month.

Everett.—C. E. Crownover, engineer in charge of the survey of the trolley line of the Everett & Cherry Valley Traction Company, has a crew of ten men at work staking out the portion of the line between Monroe and Snoqualmie Falls. Work is being pushed as rapidly as possible, so that all surveys may be completed and in readiness for the beginning of work with the opening of spring. This road is projected by J. T. McChesney and other Everett people. The promoters are men who do things and there is no doubt that the road will be completed between Everett and the Falls by the latter part of next year. It will run via Snohomish, Monroe and Cherry Valley, and will tap one of the richest timber and agricultural regions in the State, and a region withal that has been seriously retarded in its development by lack of the character of transportation that it is now to receive.

Seattle.—Articles of incorporation of the Seattle-Tacoma Short Line, which proposes to build the new interurban between Seattle and Tacoma, were filed at Olympia. The incorporators are Merle J. Wightman, C. E. Muckler and F. J. Eitel. The capital stock of the company is placed at $6,000,000. The directors of the new railroad company are former Governor John H. McGraw, I. A. Nadeau, director-general of the Alaska-Yukon-Pacific Exposition; Ira Bronson, Henry Ewing, of Calhoun, Denny & Ewing; Joseph Winship, F. J. Eitel, F. W. Baker, of the Seattle Hardware Company; P. C. Kauffman, of the Fidelity Trust Company of Tacoma; Henry Hewitt, Jr., of Tacoma; J. A. Wheeler, former general Western passenger agent of the Illinois Central; F. H. Murray, C. E. Muckler, T. Coleman Dupont, president of the Dupont Powder Company, of Wilmington, Del.; A. C. De Graw, of the Union Dime Savings Bank, of New York; Conrad Hoska of Tacoma, and Merle J. Wightman, electrical engineer of Seattle and New York. The new company has secured offices in the American Bank Building in Seattle, and in the Perkins Building in Tacoma. The promoters and backers of the new interurban line between Seattle and Tacoma propose to push the work of construction during the winter months. A contract for grading the first five miles of the road has been let to Hamilton & Rollins, of Georgetown.

OIL.

Fresno.—The Fresno Home Light & Power Company is planning an oil pipe line from Coalinga.

Oakland.—O. E. Hotle states that an official of the Standard Oil Compony, who has offices on this coast, has just returned from New York, where he succeeded in securing an appropriation of $9,000,000 additional for improvements of the properties of the Standard Oil Company, in and about Point Richmond, Contra Costa County.

Las Vegas.—The Utah-Pacific Oil Company, owning 144 acres in the Virgin River field, will soon begin work on extensive machine and repair shops at Virgin City and will equip them with the latest oil well tools. Among the directors of the company are: D. A. Thieme, J. E. Austin, of Los Angeles; E. T. Maxwell, Las Vegas. The principal office will be at Las Vegas, with a branch at Los Angeles.

Bakersfield.—It has leaked out that the Doheny interests and the Union Company have obtained from the Miller & Lux estate mineral rights to over 50,000 acres of oil land in the McKittrick and Temblor districts. The Union has obtained 25,000 acres in the Temblor country, and the Doheny 30,000 acres are toward McKittrick, in Kern and San Luis Obispo Counties. Local oil men claim that the deal will mean a union pipe line from McKittrick to the coast.

INCORPORATIONS.

Bakersfield, Cal.—The Golden West Oil Refining, Paint & Roofing Company has been incorporated with a capital stock of $900,000, by J. J. Anderson, J. E. McVean, W. C. Heffern, J. W. Foster and F. E. Burton.

Sonora, Cal.—Articles of incorporation have been filed by the Consolidated Stanislaus Water & Power Company with a capital stock of $1,000,000. The directors are: C. T. Tullock, R. R. Bigelow, W. B. Cadman, C. B. Beise and Anna C. Lane, all of San Francisco.

Merced, Cal.—Articles of incorporation have been filed by the Sierra Nevada Electric Company. The corporation is capitalized for $1,000,000, of which $5,000 has been subscribed by H. E. Huntington, William Kerckhoff and A. C. Balch of Los Angeles, and J. S. Eastwood and Frank H. Short, of Fresno, directors. The electric companies headed by Mr. Huntington have been operated for years in and about Los Angeles. A few years ago they acquired the electric street railroad system in Fresno, and for many months past reports have been in circulation to the effect that the entire San Joaquin Valley is to be grid-ironed with electric roads by the Huntington system.

TRANSPORTATION.

Lemoore.—F. S. Granger has been granted an electric railroad franchise.

Hanford.—The Supervisors have refused to grant the Granger electric road franchise.

Point Richmond.—The W. S. Rheem electric railway franchise ordinance has been finally passed.

Vallejo.—Richard Hotaling is endeavoring to extend a connecting branch of his Napa and Lakeport line from a point near Soscol, north of Vallejo, to the city of Sacramento, to float his former project.

Los Angeles.—Within ninety days an extension of the Eagle Rock line of the Los Angeles Railway Company will be in operation. Papers have been signed and the bonus turned over to the company.

Vallejo.—Melville Dozier, Jr., president of the Vallejo & Northern Railway Company, which is to build a double track interurban road from Vallejo to Sacramento, a distance of 105 miles, including branches, has stated before the Board of Trustees of Vacaville that his company will operate two lines of steamers on the waters of this vicinity. One will be a joint passenger and freight line from Vallejo and San Francisco, and the other will be a freight line only from Suisun to Port Costa, Antioch, Martinez and other points along the Sacramento River, and Suisun and San Pablo Bays.

Stockton.—It is almost certain that the Central California Traction Company will build its interurban electric line from Stockton to Modesto next spring. The company now has several gangs of surveyors in the field surveying the various proposed routes.

San Mateo.—A complete right of way has been secured by the Peninsular Electric Railroad between San Mateo and Palo Alto with the exception of three pieces of property, where the company will secure the right to lay its tracks by condemnation suits.

Ely, Nev.—Wm. B. Thompson has appeared before the City Council and asked for a fifty-year blanket franchise covering all streets and alleys in the town of Ely, in return for which he proposes to build and equip a trolley line between the depot at Ely City and the town of Ely.

Los Angeles.—The Board of Works has been authorized by the Council to institute legal proceedings to condemn a right of way along the line of the Los Angeles aqueduct, for a municipal railway. This is practically an announcement that negotiations with the Southern Pacific have been declared off.

San Diego.—C. M. Warnecke, chief electrician of the Los Angeles-Pacific Railway, is in San Diego for the Los Angeles & San Diego Beach Railway Company, to make plans and suggestions for the electricizing of the line between this city and La Jolla. It is expected that the power-house will be located at Pacific Beach. Important improvements are to be made on the road.

San Francisco.—The Supervisors' Public Utilities Committee has declined to take action on the petition of the Sunset Hills Club for the extension of the Masonic Avenue car line from its present terminus to the upper Sunset District. The committee decided that as the United Railroads had not made application for the franchise, no action could be taken by the Board of Supervisors looking to the award of the privilege.

San Jose.—Frank Chapin, general manager of the San Jose-Los Gatos Interurban, says the company can do nothing at all for thirty days. "When we are officially informed of the court's decision we will proceed with the construction of the track. The actual construction of about two blocks of track will not amount to much. Before long we will confer with the San Jose Railway and arrange to lay track that will be satisfactory to them as well as to us."

San Diego.—E. Bartlett Webster, whose two applications for street railway franchises were refused by the City Council, and whose two petitions that the two franchises be referred to the people at a referendum election were turned down on technicalities, intends to carry the question into the court for the purpose of compelling the Council to call the elections. The papers have been prepared and were to be filed November 6th, the last day on which the Council can reconsider the action on the granting of the petitions.

WATERWORKS.

Vallejo.—As the new dock has nearly doubled the capacity of the old one, a much larger pumping plant will be necessary.

Los Angeles.—The Water Board has awarded a contract to the Risdon Iron Works to build an auxiliary pumping engine for the Buena Vista station, on a bid of $25,980. H. P. Boynton Company will supply gate valves for $4532.

Monrovia.—Consulting Engineer Parker has made report of the quantity of pipe to be used in the proposed pumping plant for the city, also plans and specifications for a new shaft different from the one proposed.

Goldfield, Nev.—The Water Company has completed the task of supplying Goldfield with water from the Lida district. By January 1st, a million gallons daily will be developed. The Malapai pumping station, with a capacity of 400,000 gallons, will be duplicated soon and run by thirty-horsepower electric equipment.

Berkeley.—A committee consisting of Trustees Schad, Conner and Schmidt, has been appointed by President Ferrier to confer with the representatives of the bay cities in regard to the Hetch-Hetchy water supply for Berkeley. The proposals to furnish this city with water from the Sierras have met with considerable favor.

Oakland.—The ordinance and judiciary committee of the City Council has recommended to the Council the passage of an ordinance appropriating $40,000 for a salt water pumping plant as auxiliary fire protection. The appropriation will cover the cost of the power station, pumps, engines and other equipment. To pipe the business district will require a further appropriation.

ELECTRIC RAILWAYS.

Tacoma.—The Tacoma Railway & Power Company has begun the construction of a line to Bismarck, a thriving suburb southeast of the city.

Seattle.—A new franchise was introduced last week in favor of the Seattle Electric Company for a car line on Twenty-third Avenue from Jefferson Street to the University.

North Yakima, Wash.—The directors of the Yakima Valley Transportation Company have decided to abide by the original franchise granted them and will proceed with the construction of their line at once.

Olympia.—C. D. Hillman, of Seattle, has placed an application before the Board of County Commissioners for a franchise to build and conduct a double track steam and electric road through this county from Boston to Centralia, by way of Olympia.

Coeur d'Alene, Idaho.—Actual grading was begun upon the Idaho & Northwestern Railroad, which is being projected through the Coeur d'Alene Indian Reservation, connecting the Spokane & Coeur d'Alene electric line with the Oregon Railroad & Navigation Company's line and the Chicago, Milwaukee & St. Paul Railroad. Several carloads of grading tools were taken in to the point where work began. About thirty teams will be set to work at once. The right-of-way is being cleared rapidly.

Chehalis, Wash.—The franchise of the Centralia-Chehalis Electric Railway & Power Company, which has been before that body for several months, has passed to its final readings. There has been a hard fight by prominent citizens of Chehalis against the granting of the franchise; the principal reasons being that the company was a Centralia concern and that its power plant would not be located in Chehalis. B. J. Weeks, the promoter of the enterprise, is prepared to commence work immediately and promises to have the whole thing completed within a year.

Red Lodge, Mont.—The Red Lodge Board of Trade has made a contract with Russell Kimball, a civil engineer, for a survey and topographical map of the two proposed routes for an electric railway to Bear Creek from Red Lodge. There was subscribed $350 to pay the expenses of the survey. When it is completed the Board of Trade will secure estimates of the cost of the proposed road, and will then proceed to finance it. There is an abundance of power for electrical purposes, as the Rocky Ford Creek has a flow of ninety-eight feet to the mile and passes through the town. The line when in operation will place Red Lodge within fifteen minutes ride of all the coal mines in the Bear Creek region.

Anacortes, Wash.—Ben. J. Weeks and H. Speer, representing Eastern capitalists, among whom are said to be the Guggenheims, of smelter trust fame, have been in the city this week in the interests of an electric railway, for which the City Council will at its next meeting be asked to grant a franchise. The proposed road will be an interurban connecting Anacortes with the Bellingham-Seattle line at Burlington and extending up the Skagit Valley. The company which is being formed with capital stock of $1,000,000, will include, besides the Eastern capitalists, E. S. Martin, of the Bank of Commerce, W. F. Robinson, of the Robinson Fisheries, and several wealthy farmers of the Swinohish Flats. Surveys for the line will be commenced next week. Weeks is promoter of the company which is to build an interurban line between Chehalis and Grays Harbor as a branch of the Seattle-Tacoma-Portland line.

Portland.—The Portland Eastern Railway Company, that will build a road southeastward from Portland through Central Oregon to a connection with one of the Eastern trunk lines, was quietly incorporated June 3, with a capital stock of $5,000,000. The incorporators are E. P. Clark, R. C. Gillis, Arthur H. Fleming, E. B. Colwell, Robert T. Linney and C. W. Miller. The first three are the Los Angeles capitalists behind the Portland Railway, Light & Power Company, while the latter three are Portland men in the employ of that company, whose names were used for convenience in incorporating. E. P. Clark, president of the Mount Hood Railway & Power Company, and the man who mapped out the project of the Portland Eastern, a later development of the original scheme, will be in Portland within the next ten days and will probably be ready to make official announcements of the purposes of the Portland & Eastern Railway.

WATERWORKS.

Yuba City.—Chas. Andross will put up a new plant on the Cooper tract and will erect a high steel tower with a tank on top that will hold 100,000 gallons.

Hayward.—Preparations are being made by the People's Water Company to open the recently acquired watersheds in Cull and Crow Canyons. A series of wells will be sunk and pumping plants established. Connections by tunnel will be made with the water lines and reservoirs in Redwood Canyon. To complete this will require two years. Machinery is being shipped to Hayward, and the water company has bought from the Southern Pacific Company a large shed and cookhouse, the shed to be used as a warehouse.

TELEPHONE AND TELEGRAPH.

Redding, Cal.—Shasta County is to have a new telephone line eight miles in length, which will extend from the terminus of the present Redding and Wengler line at Wengler to Big Bend. A principal promoter of the new concern is T. G. Moore, resident of the Big Bend country.

The new telegraph-telephone system recently installed by the Louisville & Nashville, known as the telegraphone, is in full operation between New Orleans and Mobile, with connections at all the intermediate stations. In the operation of this system one wire is employed in the transmission of both telegraph and telephone messages, which may be sent either interchangeably or simultaneously, without the slightest interruption or confusion. Another local road equipped with the same system is the New Orleans Terminal Company, which has employed it for some time past, and finds it most satisfactory.

TRANSPORTATION.

Sacramento, Cal.—Ground has been broken for the new South Side route of the local street car system, which is to run from K Street down Seventh to T Street, thence to Twenty-eighth Street.

Stockton, Cal.—The Central California Traction Company has signed a contract with the Wells-Fargo Express Company by which the express company will handle express packages over the interurban lines of the traction company.

Los Angeles, Cal.—An ordinance has been adopted granting to F. W. Flint, Jr., the right to construct and operate electric street railways upon certain public streets of Los Angeles, commencing at the intersection of Hill and Eighth Streets, along Hill Street, to Sixteenth, along Sixteenth to Georgia.

San Francisco, Cal.—At a recent meeting of the Supervisors' Joint Utilities, Street and Judiciary Committee, Supervisor Sullivan submitted an ordinance which, if adopted, will compel the United Railroads to put under ground its trolley wires along the lines of the former cable systems which were transformed into trolley roads under the ordinance passed by the late Board of Supervisors.

Los Angeles, Cal.—The extension of the West Sixth Street electric line of the Huntington city and suburban system has been completed, and, according to posted notice, regular car service began last Sunday. A bonus of $18,000 is asked for the further extension of the new road from Melrose up Vine Avenue to Sunset and Prospect. About one-half of this sum has been subscribed, but the matter of completing the bonus is not being rushed.

Napa, Cal.—The officials of the San Francisco, Vallejo & Napa Valley electric road have received word that the last consignment of steel rails for the up-valley extension to St. Helena has reached San Francisco. The shipment consists of 3,076 rails, which were manufactured at Steelton, Pa. It is promised that New Year's Day will witness electric cars between here and St. Helena. Four more new passenger coaches for the road have reached Bakersfield from Niles, Ohio, and will be here in a few days. The cars are of the closed type.

San Francisco, Cal.—The Supervisors' Public Utilities Committee are hesitating at recommending a grant of franchise for the Devisadero and Mission cross-town electric railway, because E. L. Willcut, secretary of the United Railroads, had bid for the franchise, instead of the corporation. Thornwell Mullally says that the reason the United Railroads did not bid in its own name was because it would result in the charter applying to connecting roads operated under previous franchises, and his corporation did not want to operate any more roads under charter restrictions.

Sacramento, Cal.—A number of Northern Electric engineers and surveyors and the City Superintendent of Streets and the City Engineer have gone over the proposed freight line of the new electric road on C street to Thirty-first, down the latter thoroughfare to X, and thence to the water front, for the purpose of making some necessary surveys. The thirty days which must elapse from the time the Mayor signs a franchise until it becomes a law, have gone by, and the Northern Electric is now pushing construction work on its freight line in Sacramento.

Fresno, Cal.—Manager S. G. Wishon, of the Fresno Traction Company, says: "Double-tracking of the Recreation Park line will commence as soon as the rails arrive from Pittsburg, and we have just learned that they have been shipped; when they arrive depends on freight conditions." Mr. Wishon has returned from a trip of inspection to the company's power house in the mountains, where he went with Vice-President A. C. Balch, of Los Angeles, who came here to see how work is progressing on the enlargement of the plant. The work at No. 2 power plant is going along very satisfactorily, and the plant will be increased from 2,500 horsepower to 12,500 horsepower, and generating machinery will be installed as fast as the demand for power comes in.

OIL.

Coalinga, Cal.—The Southern Pacific is tearing down a half-million-barrel oil reservoir, built at Coalinga four years ago. The company, it is said, has never had any surplus oil to store, and the reservoir has never had a barrel of oil in it since it was finished.

Kern River, Cal.—Some time ago the Associated Oil Company started to drill twenty more wells, but the increased demand for oil has made it necessary to sink more holes. Before the work is completed there will be sixty new wells sunk by the Associated Oil Company in the Kern River field.

Los Angeles, Cal.—The Maricopa oil field scores with a 600-barrel gusher at a depth of 720 feet, and it is reported that 112 feet is through oil sand. It flowed at the 600-barrel-per-day rate when first tapped, and is improving. The oil is about 14 gravity. The well was drilled by the McKutcheon Bros., who are developing their land adjoining the Superior Oil Company's ground. They will proceed immediately to drill another well, and are erecting a 60,000-barrel reservoir.

Salinas, Cal.—Fred N. Rogers, a nephew of H. H. Rogers, of the Standard Oil Company, has been in Salinas looking after the leasing of oil lands in the Southern part of this county. Men have been engaged in securing locations from Paso Robles north, for some months, in a very quiet way. It is no longer a secret, however, that Standard Oil has got hold of thousands of acres, paying cash for leases, or for lands when buying them outright, in this county, and still they are wanting more, but as to when they will begin to sink wells, they are very reticent.

Stockton, Cal.—After six weeks of secret investigation, fine traces of oil have been discovered near Byron, and already arrangements have been made by capitalists to expend about a quarter of a million dollars in developing that section. Three oil men, who have had considerable experience, with W. J. Rhoades and Fred Casteline, have been quietly investigating the ground on which the oil showed some months ago. All of the men refuse to talk further than to say that rigs will be erected soon and drilling commenced, to determine if there is a paying strata of oil.

TELEPHONES.

Seattle.—Application of W. D. Norman et al., for telephone franchise. Hearing November 12th.

Genesee, Idaho.—A renewal franchise was granted the Genesee Telephone Company, of which H. A. Morgan is manager.

Kalama, Wash.—A franchise has been granted the Northwestern Long Distance Telephone Company for a line in this city.

Woodland, Wash.—A franchise has been granted to the Northwestern Long Distance Telephone Company to construct a line in and through this city.

Eugene, Ore.—Rev. Miner, who is connected with forestry service, is now engaged in making arrangements for a telephone line along the McKenzie from Eugene to Foley Springs.

Newport, Wash.—The proposed franchise of Anderson & Hall for a telephone and telegraph system within the city limits of the city of Newport, was read and passed to second reading and reference by title.

Puyallup, Wash.—E. G. Pake, by his attorneys, Burkey, O'Brien & Burkey, asked for a franchise allowing him to construct and maintain telephones and telephone stations in the different sections of the city.

Walkerville, Mont.—Representatives of the Independent Telephone Company were present at the Council meeting and secured a franchise allowing the use of the streets and alleys for a pole line, to be used under certain restrictions. One free phone for the city hall was donated by the company.

Bellingham.—The Farmers' Mutual Telephone Company is stretching the wires for a main line between this city and Blaine, which will be completed in about ten days. Announcement is made that the special meeting of the stockholders of the company, which was to have been held Oct. 19th, has been delayed one week.

Weiser, Idaho.—Mr. E. H. Darling, telephone expert for the forest service, has just completed estimates for several proposed telephone lines through the Weiser national forest. The longest of these lines will extend from Indian Valley to the summit of the divide between Indian Valley and Long Valley. The line, when built, will follow up the Little Weiser River from Indian Valley to the mouth of Grizzly Creek to its head and on to Mill Creek Ranger's station; thence northeast along the old Crane Creek-Van Wyck wagon road, to what is known as the Bull Corrals, where the service has selected another site for a Ranger's station to be known as the Lookout station. The Valley Telephone Company's line at Indian Valley, will connect with the Rocky Mountain Bell Telephone Company's line at Cambridge. Supervisor J. B. Lafferty has already been authorized to build a line from Hitt Mountain to Cuddy Mountain by way of the Brownlee Ranger's station near Heath, and a crew of about twelve men is now employed under the supervision of John Goull in its construction. It is expected that the Bell Telephone Company will build from Cambridge to Brownlee's Ferry in the near future, which line will connect with the one now being built by the forest service. The total estimated cost of the proposed telephone lines in the Weiser forest is $4,386.79.

TRANSMISSION.

Washington—It has been announced that the Forest Service has granted to the Southern Pacific a permit to build a power house and conduits in the Cascade National forest in Oregon.

Mina, Nev.—The work on the survey for a power line by the California-Nevada Power Company, has commenced. One of the projected lines is from Bodie to Manhattan and Mina. J. S. Mullen is in charge of the survey work of the company, and is now at the camp in Huntoon Valley.

Red Bluff, Cal.—The Haze Company has deeded to the Battle Creek Power Company 887 acres in section 1, 320 acres in section 2, 520 acres in section 3, and 552 acres in section 5, all in township 29, north of range 1 east—a total of 2,380 acres, and water rights. About 4,000 inches of water in Ripley Creek will be used to operate a 2,000-kilowatt generator.

Oroville, Cal.—The Oroville Water & Light Company is preparing to erect a new power plant at Coal Canyon, eight miles above Oroville, where 2,000 horsepower will be developed, and provisions will be made to increase the capacity of the plant as required by the growth of the community served. This plant will be used to supply Oroville with additional power and light.

Oakland, Cal.—E. M. Downer has put in an application to the Board of Supervisors of Alameda County, requesting a franchise "to erect an electric power plant and to run the necessary wires anywhere in the county." He has established an electric light company, of which he is president. Whether or not he is trying to reach into Alameda County on his own account or in the interest of the Southern Pacific, remains to be seen.

Redding, Cal.—By a deed filed for record October 8th, the Northern California Power Company secured the Canyon Creek water right hitherto owned by Nils A. Jacobson, as located in 1888 by John Seagren and N. A. Jacobson. With it goes the south half of the northeast quarter and the west half of the southeast quarter of section 28-32-1, containing 160 acres. The property is in Millville township, and the water right is designed as a feeder for the Killare power house on Old Cow Creek. Another deed, passing from H. A. Tedford to the Northern California Power Company, conveys a water right on North Battle Creek, together with a ditch conveying water to a point near the northern portion of the land.

ELECTRICAL.

Pasco, Wash.—Increase of capital stock of Pasco Light & Water Company from $25,000 to $50,000.

Toppenish, Wash.—Toppenish Electric Power & Light Company; $15,000; by Everett F. Bohannon and G. G. Lee.

Seattle, Wash.—The Reynolds Electric Company, $10,000; by Harry F. Reynolds, Roy R. Gruwell and Louise Reynolds.

OIL.

Bakersfield.—The Occidental Oil Company, through its president and secretary, F. M. Graham and E. G. Hailstone, has leased to the Monarch Oil Company the northeast quarter of the northwest quarter of section 2-11-24. The lessees are to pay a yearly rental of $500.

San Francisco.—The Southern Pacific, operating under the name of the Kern Trading & Oil Company, will have completed by January 1st the seventy-five wells they started drilling the first of this year. Whether this will add materially to their present production remains to be seen. All new wells in the Kern River field that they have drilled this year have been very small producers.

Bakersfield.—The shipment of oil from the Kern River field is steadily increasing. The shipments during the past month aggregated 5017 carloads, or 1,500,000 barrels. The shipments in August totaled 5,018 carloads, but as there were thirty-one days in August and thirty in September, the shipments in the latter month were in reality 350 carloads more than in August. The shipment of oil does not represent the production. There is more development under way now than there has been for some months. New wells are being opened up and the production is increasing, and it has not yet reached the point when oil can be supplied without drawing from storage.

Los Angeles.—The latest strike of importance in the Sherman oil fields is Well No. 139, on the Arcturas lease of the Amalgamated Oil Company. The vein was struck last week. Since that time there has been a steady flow from the well averaging 800 barrels every twenty-four hours. The well is located in the northwest corner of the Arcturus lease and is the eightieth that the company has sunk in the field. A test of the oil from the new well shows it to be of good grade, registering 17 gravity, Baume scale. About 2400 barrels of oil have been taken from the well since the strike was made, but the flow shows no signs of playing out, and the drillers believe that it will continue for an indefinite length of time. All of the wells surrounding No. 139 have turned out good, and several of them have been pumped for three years and are still producing without signs of exhaustion.

POWER AND LIGHT.

New Westminster, B. C.—A company composed of Vancouver men and known as the British Columbia Power & Electric Company, was granted 1,500 inches of water by Government Agent C. C. Fisher recently, from the Cheakmus River, a tributary of Squamish River. Mr. Tiffin, of the firm of Phillips, Tiffin & Laursen, Vancouver, appeared on behalf of the company, and formally applied for the record. A complete report on the power project was submitted by the company's engineer. This document stated that the proposed plant would generate 20,000 horsepower and would supply power to any point within a radius of seventy-five miles of the plant, including the city of Vancouver. Two routes for the power line from the plant to Vancouver had been located; one along the shore (East Howe Sound), a distance of sixty-one miles, and the other over the mountains and across the Second Narrows, a distance of forty-seven miles. The plant when completed will have cost in the neighborhood of $1,250,000.

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